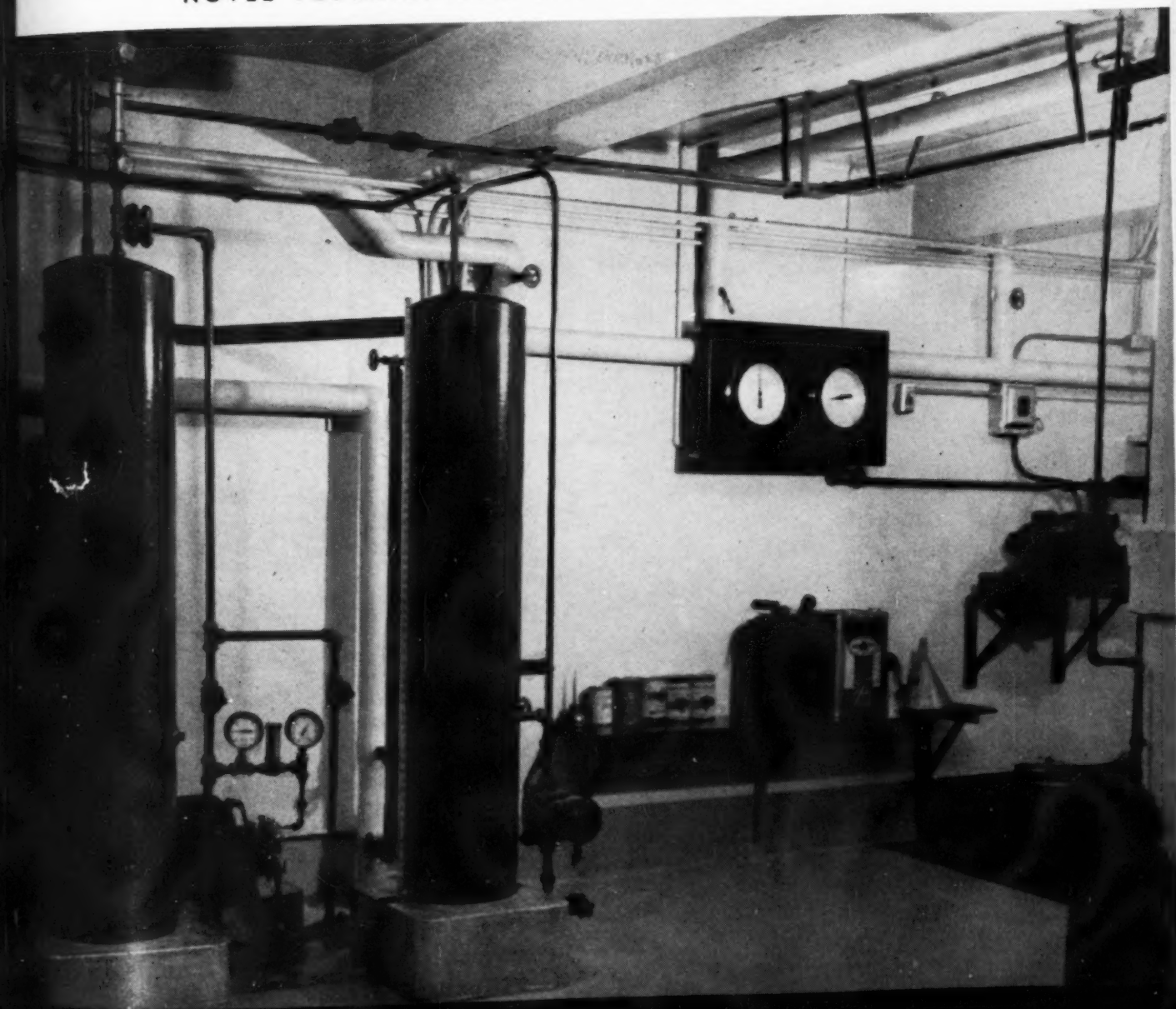
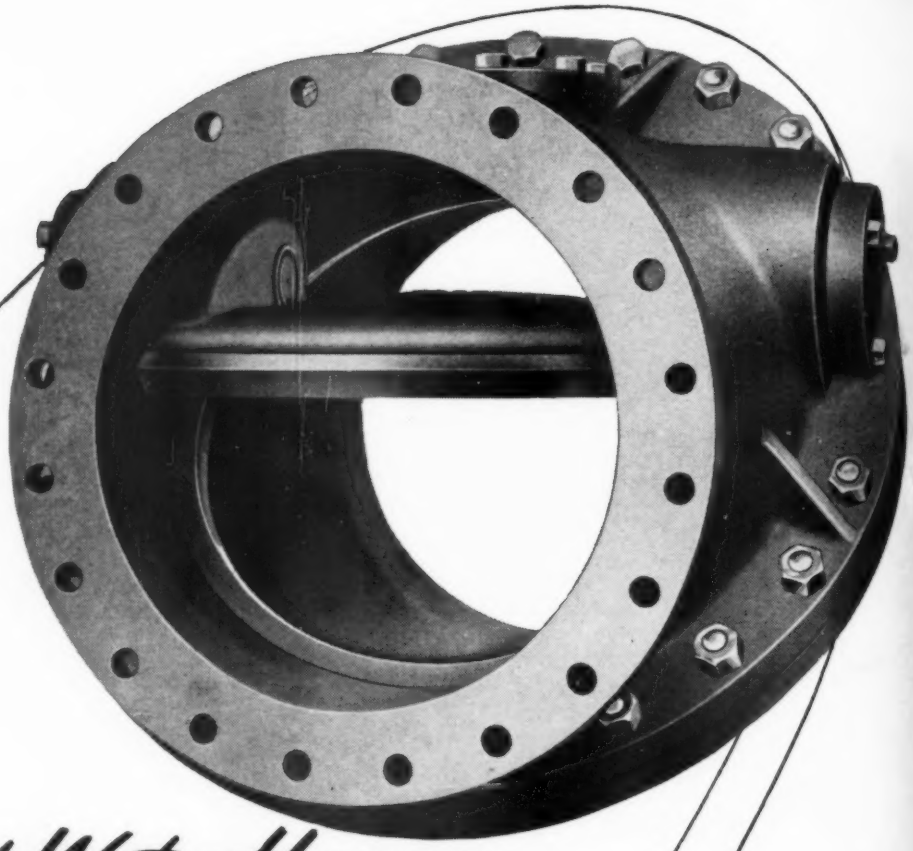
WATER & SEWAGE WORKS

NOVEL FLUORIDATION STATION OF MADISON, WIS.





Prevent Water Hammer
with the "CUSHIONED CLOSING" of

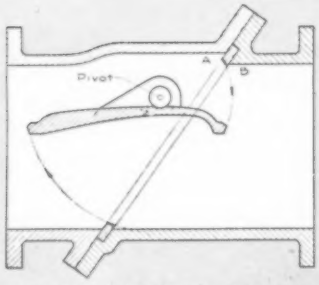
CHAPMAN

TILTING DISC CHECK VALVES

Chapman Tilting Disc Check Valves *work with . . . not against . . . the stream.* As a result, destructive pipe line stresses are practically eliminated. Head losses, as compared with conventional type check valves, are reduced 65% to 80%.

This balanced disc rides smoothly on the flow. It lifts away easily when opening . . . closes quickly and quietly. There is no rubbing on the seat . . . no slamming. Hinge pins, seats and bearings wear far longer.

These are facts. Write today for engineering data and reports of tests. Valves available in either iron or steel.



Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

The Chapman Valve Manufacturing Company
INDIAN ORCHARD, MASSACHUSETTS

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. April, 1949. Volume 96. Number 4. Published monthly by Gillette Publishing Co., at 404 North Wesley Ave., Mount Morris, Ill. Per copy, 25c; except *this issue*, 75 cents. Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as second-class matter March 4, 1948, at the post office at Mount Morris, Illinois, under the Act of March 3, 1879. Executive and business offices, 22 W. Maple St., Chicago 10, Illinois. Editorial office, 155 E. 44th St., New York 17, N. Y.

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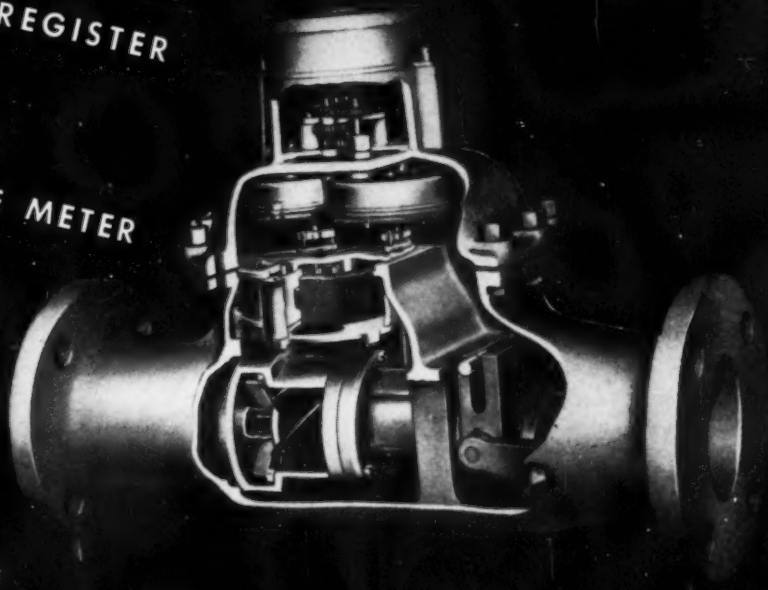
SUPER-ACCURATE EMPIRE METER

STRAIGHT-THRU FLOW
(FOR PROPELLER UNIT)



COMPACT DIMENSIONS
LIGHT WEIGHT

ROLLER BEARING
MOUNTED PROPELLER

SWING ACTION
COMPOUNDING VALVE

ROCKWELL

"But what ails Henry, Doctor?"

MAJOR credit for the virtual wiping-out of the typhoid fever scourge of 50 years ago is due to the growth and progress of public water works systems. In 1899, when our Company was established, there were about 3,000 public water works systems in America. Today, 12,000 water works furnish 85 million people with eight billion gallons of water per day, 90 per cent of which requires and receives treatment to make it safe.

The gas industry and sanitation have also made notable contributions to better health and living in the past 50 years. Today, over 20 million families use gas for cooking, refrigeration, or home heating. More than half of our urban population is now served by 6,000 sewage treatment plants.

As the largest producer of cast iron pressure pipe for water, gas and sewerage service, we too can look back on a half-century of progress in manufacturing methods, production standards, quality controls and facilities for research and development. The service records of our early product are truly remarkable. yet U. S. Cast Iron Pipe as we make it today is demonstrably superior—in strength, in toughness and in uniformity.

To those responsible for the great progress in water supply, gas and sanitation service and their contribution to better health and living over the past fifty years, America pays tribute.

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1899-1949

U. S. Pipe & Foundry Co.

Makers for 50 years of cast iron pipe for water, gas and sewerage service.

General Offices: Burlington, N.J.

WATER & SEWAGE WORKS

WATER SUPPLY—SEWAGE DISPOSAL—INDUSTRIAL WASTE TREATMENT

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

COMING

Chlorination Control at Chicago

Will tell the interesting features of chlorination control in the new Chicago Filtration Plant, where chlorine is applied at various points throughout the plant to maintain definite residuals which are measured mechanically and transmitted to the distant laboratory for indicating and recording. This story is the contribution of a long-time Editorial Associate of *Water and Sewage Works*—

JOHN R. BAYLIS
Engr. of Water Purification, Chicago

Eradicating Sewage Flies

Sets forth experiences in the use of D.D.T. for eradication of Psychoda and other fly breeding around the Joint Disposal Plant of the Los Angeles County Sanitation Districts, and describes step-by-step procedure which can be applied at plants of any size. The author is Editorial Associate—

A. M. RAWN, Chief Engr.
Los Angeles County Sanitation Districts

Mechanization of Water Utility Operations

Is the order of the day and the trend of the times. If you want to know how important this trend is and what mechanization can do for your plant read this article by—

J. G. CARNS and W. D. MONIE
Amer. Water Works Co., Inc.

A Simplified Titration Unit for Determination of Residual Chlorine

Is an illustrated description of a relatively simple laboratory unit for determination of the various classes of residual chlorine by the amperometric titration method. This inexpensive unit was designed and assembled by the author—

W. A. MAYHAN, Chief Chemist
Munic. Water Works, Little Rock, Ark.

Operation of Small Water Plants

Is the general title of a new series of articles by the same author whose series on the "Operation of Small Filtration Plants" we published during the past year. The first article of the new series discusses the matter of "Office Personnel and Office Procedures." The author is—

A. E. CLARK, Gen'l. Mgr.
Nashville (Tenn.) Suburban Utility Dist.

Sewer Stabilization by Suspension

Reveals the method employed in Shreveport, La., for rebuilding an unstabilized sewer through a very difficult soil condition. The unique method of stabilization involved a suspension of the line from above. The method employed is described by—

T. L. AMISS, Supt. & Engr.
Dept. of Water & Sewerage, Shreveport, La.

Sewage Treatment Plants for Small Housing Developments, Institutions, and Camps

Are often taken for granted when they should be given careful consideration. In this article, the design, operation, and maintenance of such plants are thoroughly discussed by—

R. W. SIMPSON, San. Engr.,
Gilbert Associates, Reading, Pa.

Determination of First-Stage B.O.D.

By means of a chemical oxygen demand test is becoming a nearer possibility, according to the results of this study, which reports a continuation of the work originally published in this magazine in May, 1947, by—

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Fort Jackson, So. Car.

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co-ordinated

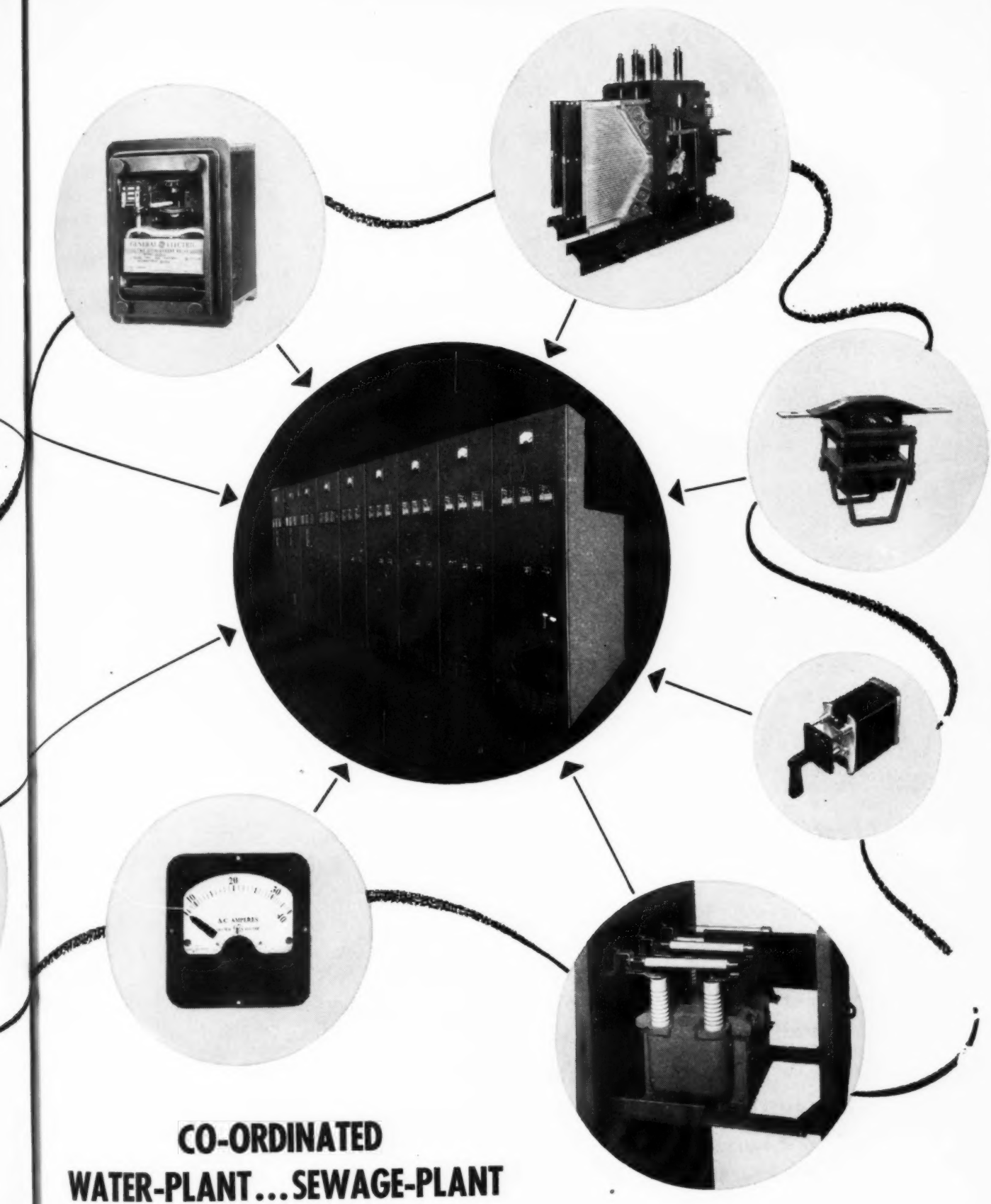
in one functional package

G-E metal-enclosed switchgear designed, factory-assembled and tested to solve all your protection, metering and relaying problems

A simple, one-line diagram is all the information our water and sewage engineers need to go to work on your power-distribution problem in new or expanding plants. From this diagram they can help you plan your distribution system and the necessary switchgear control and protective equipments to provide efficient flow of power to your load areas. These equipments will include circuit breakers of adequate interrupting capacity, relay protection, instrumentation and other associated devices, assembled and interconnected within streamline metal enclosures.

More Information?

Your consulting engineer or General Electric representative will tell you more about these equipments and help you plan your entire electrical layout. Consult him early, so that you can profit by co-ordinated planning and thereby simplify engineering, construction and installation. *Apparatus Dept., General Electric Company, Schenectady, N. Y.*



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ELECTRIFICATION

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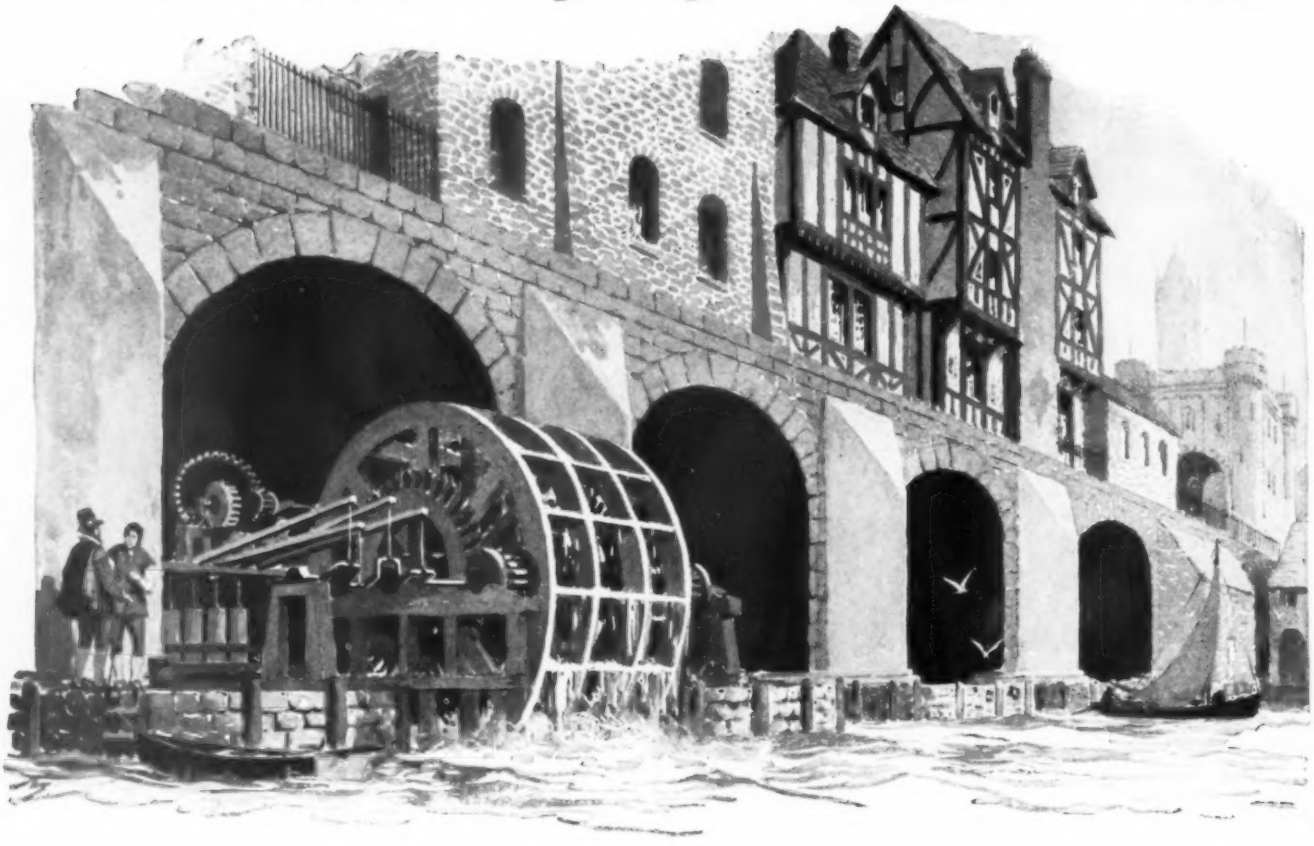
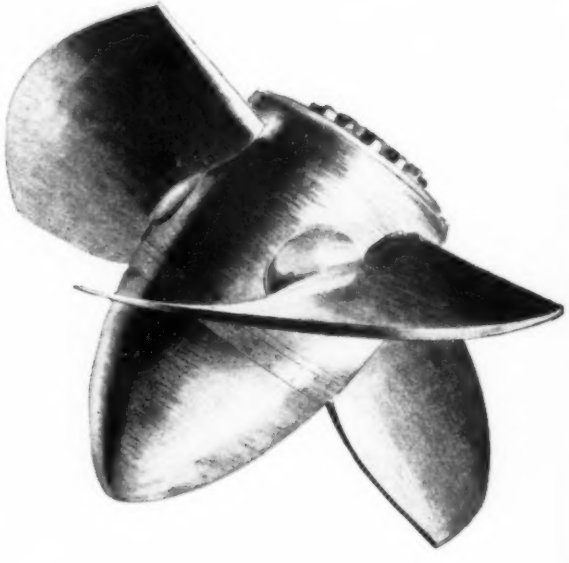
in 1582 when this machine pumped London's Water



SKIP the centuries!

In this country alone there are systems that would shame London's great contribution, even in our smallest towns.

A Parade of Progress in which Smith Rotovalves and Axial Flow Pumps have marched in the very forefront! Good reason for putting your hydraulic problem in our hands, isn't it?



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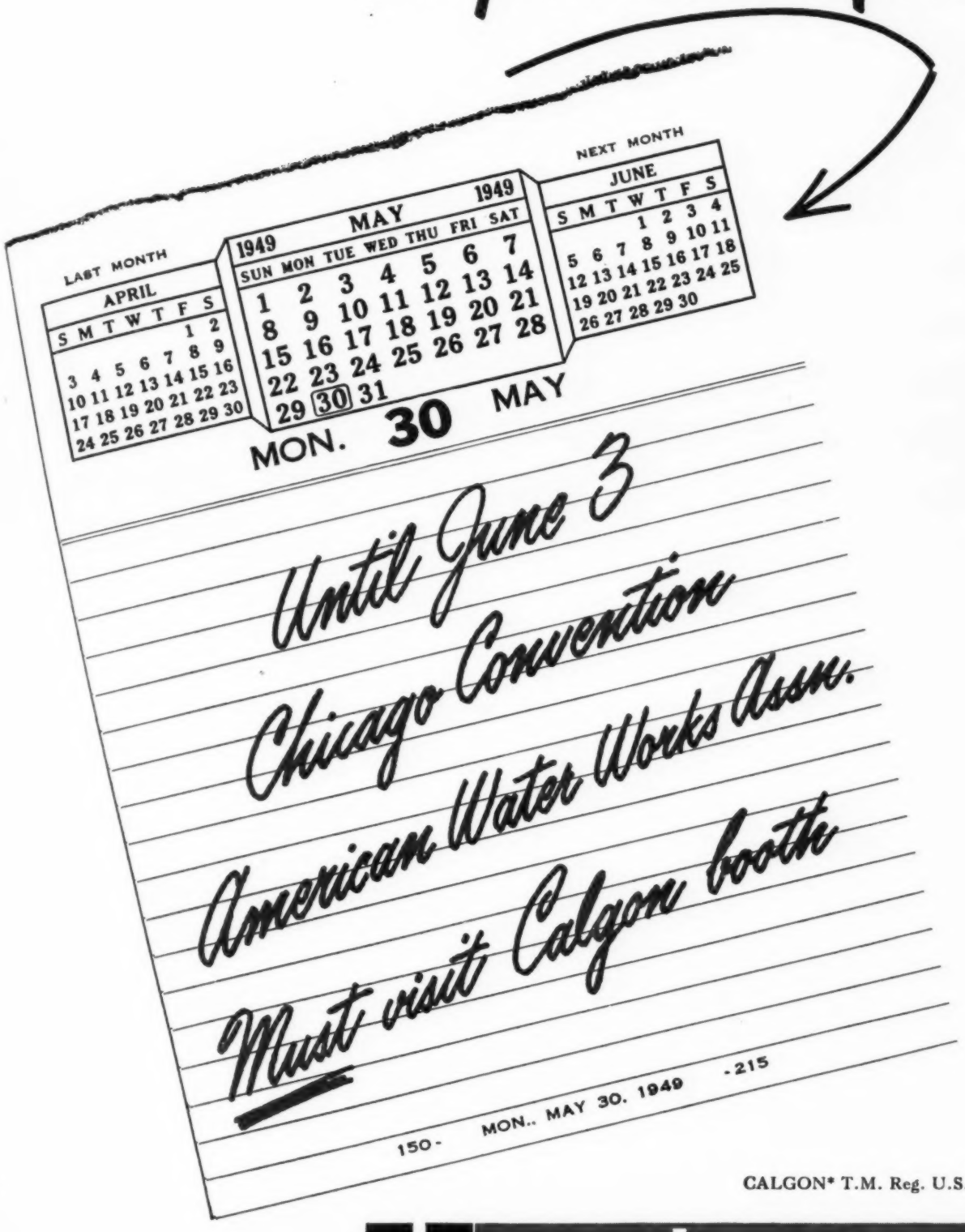

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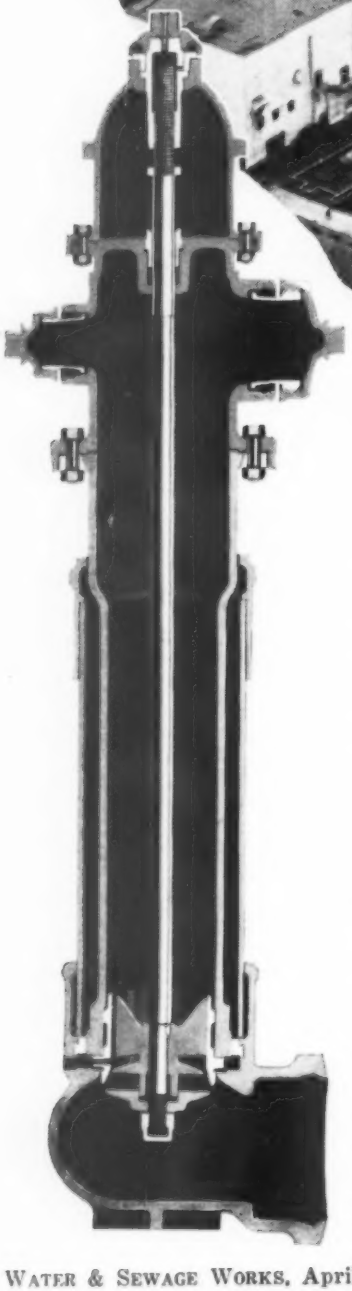


MERCED, CALIF.

"One of America's Safest Cities"

THE MATHEWS FIREMEN SAY

THEY FIGURE IT OUT THIS WAY: Merced, California is protected by Mathews Modernized Hydrants, and wherever these hydrants are, *there* is safety plus.

Some Mathews in service today started their long and trouble-free life even before there was a seedless orange in the state of California. This *proved* dependability, plus the most modern features, makes today's version of the time-honored Mathews a standard by which all hydrants are judged. The thread is proof against rusting and deposits of silt. The revolving nut is protected against rain and wind-borne dust. The main valve is true compression-type; the drain valve drains perfectly dry. All working parts are contained in a removable barrel—easily and quickly replaced when every second can count.

Send for descriptive literature. Read for yourself, point by point, why there are over 500,000 Mathews in service today, and why you owe it to your community to provide this safety plus.

OTHER MATHEWS FEATURES: Head can be rotated 360° • Replaceable head—nozzle outlets easily changed • Nozzle levels raised or lowered—no excavating • Stuffing box cast integral with nozzle section • Only one part to lubricate—operating thread • A modern barrel makes even the oldest Mathews new

MATHEWS HYDRANTS

***Made by* R. D. WOOD COMPANY**

Public Ledger Bldg., Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

HORTON
elevated water tanks

Uniform Water Pressure for Your City

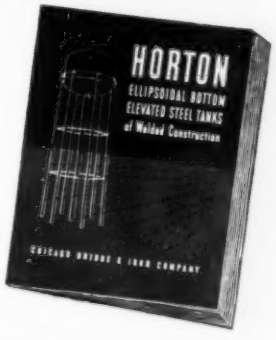
Do you have a serious pressure problem in your municipal water system? That's often the case in a city where there is an unusually wide daily variation in the rate of consumption. One of the best answers is a reserve supply of water in a Horton elevated tank. With elevated storage, the wells or water intakes, pumping equipment, filtration plant, and transmission mains can be designed to take care of average needs, and the reserve in the tank will provide the additional water needed during peak demand periods. Some of the other advantages of elevated storage include reduced pumping costs, water pressure during emergencies or power failures, and lower fire insurance rates in your community.

Horton tanks are butt-welded throughout. There are no rivets used, no caulking, and there is no leakage from the seams. The welded construction makes it possible to keep corrosion at a minimum by eliminating sharp edges and inaccessible corners or crevices where dirt might collect. Horton tanks are graceful structures, with smooth, curved surfaces and simple details.

Let our engineers show you how elevated storage can be used in your community. Our nearest office has full information and will be glad to make quotations.

The 200,000-gal. Horton elevated tank shown above was erected at Canyon, Texas, near the city's center of population. The tank is used to provide additional water pressure over the entire city area of 2 sq. miles. In Canyon, the daily rate of consumption varies from a minimum of 240,000 gallons to a maximum of 1,010,000 gallons per day.

Write for your copy of this bulletin on Horton ellipsoidal-bottom elevated steel tanks. It contains information on the advantages of gravity pressure in municipal water distribution systems.



CHICAGO BRIDGE & IRON COMPANY

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Birmingham 1 ..... 1586 North Fiftieth Street	Houston 2 ..... 2115 National Standard Building	Salt Lake City 1 ..... 1550 First Security Bank Building
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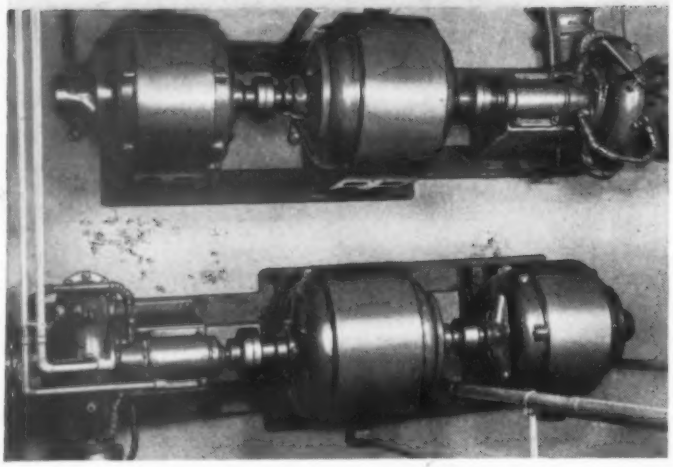
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PENNSYLVANIA

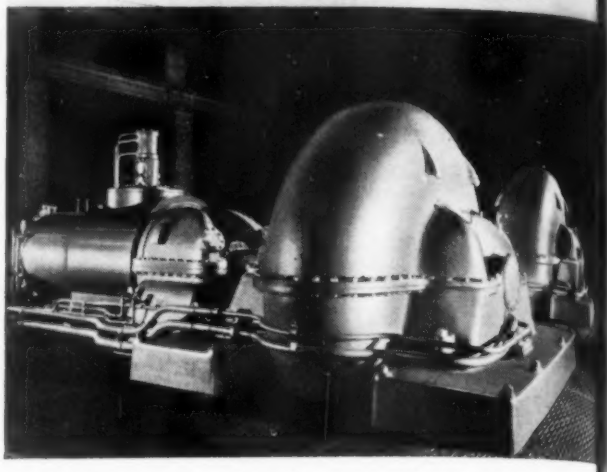
World's Widest

CENTRIFUGAL PUMPS



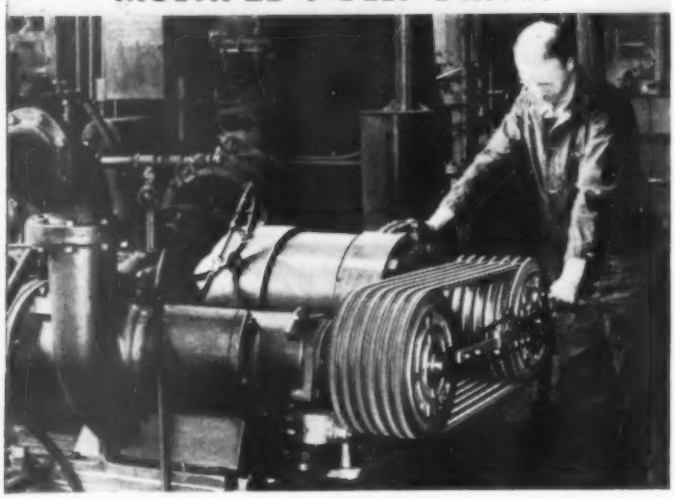
SEWAGE BOOSTER STATION in midwest municipality uses A-C pump-motor "team." Dual motors provide capacity and head variation. Allis-Chalmers builds all types of pumps for water and sewage works, fire protection, drainage and other public works. Capacities range up to the largest size.

TURBINES AND BLOWERS



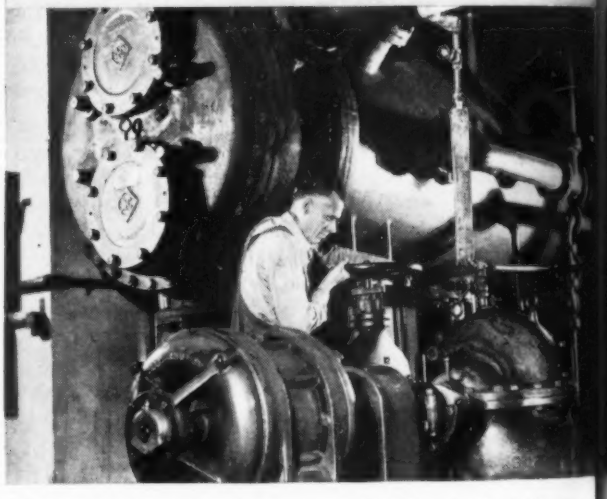
ALLIS-CHALMERS turbine-driven centrifugal blowers in Milwaukee sewage treatment plant. A-C builds multi-stage blowers up to 130,000 cfm, 35 psig; single-stage—600 to 35,000 cfm. 1 to 6.25 psig; rotary compressors—44.5 to 1,684 cfm, 5 to 35 psig; vacuum pumps—14.5 to 5,300 cfm, 18 to 28.5 in. hg.

MULTIPLE V-BELT DRIVES



TEST FLOOR VIEW of centrifugal pump with Vari-Pitch Texrope speed changer. This unit now controls the sludge level in ferric chloride dosing tank in a midwestern sewage plant, with pilot operation instead of manual as shown. A-C V-Belt drive line includes all sizes and types for all applications.

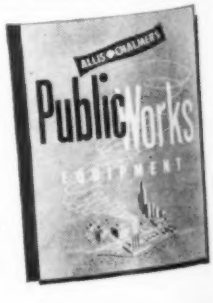
SURFACE CONDENSERS



POWER STATION equipment supplied by Allis-Chalmers includes turbines; condensers; condensate, boiler feed-water and circulating water pumps; air ejectors. Typical of the power plant installations A-C has been building for over 40 years is the one shown above in a midwestern sewage plant.

SEND FOR NEW PUBLIC WORKS BULLETIN

Description of A-C equipment — published for Public Works engineers. Send for your copy today. Bulletin 25B6607, ALLIS-CHALMERS, MILWAUKEE 1, WIS.



Range OF MAJOR PUBLIC WORKS EQUIPMENT!

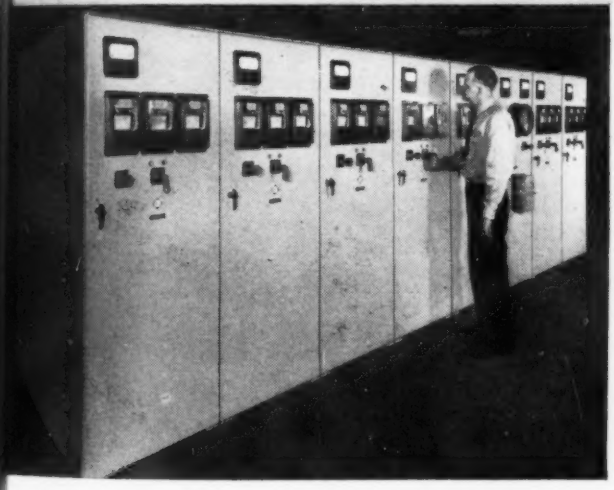
At Allis-Chalmers You Get *Complete Coordination* of All Electrical and Mechanical Equipment

WHAT DOES THIS LEADERSHIP in range of public works equipment mean to you? It means that you can get individual units of equipment *tailor-made to work together* . . . designed and built by one company.

Engineers know that for maximum efficiency, equipment must work as a team—*the right drive for the right pump—the right control with the right motors.* It is this coordination of equipment that saves you money and engineering worries. No other company offers you this kind of equipment engineering. No other company can supply you with so many different types of major equipment with emphasis on making them work together as an efficient team.

Whether you are planning to modernize or expand, call on Allis-Chalmers. Get in touch with your nearest A-C office or write to ALLIS-CHALMERS, MILWAUKEE 1, WIS.

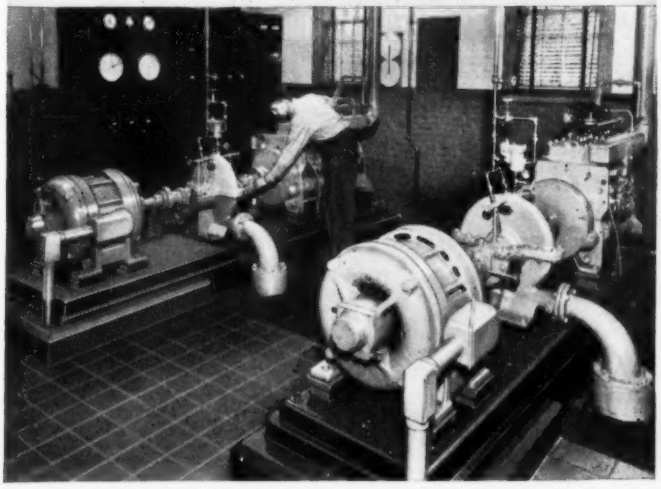
POWER DISTRIBUTION



METAL-CLAD SWITCHGEAR was introduced to the U. S. by Allis-Chalmers . . . and today "A-C" offers a complete line for all applications. Electrical products include motors, transformers, circuit breakers, unit substations, motor-generator sets, mercury-arc rectifiers, switchboards and industrial control.

A 2432

MOTORS AND CONTROL



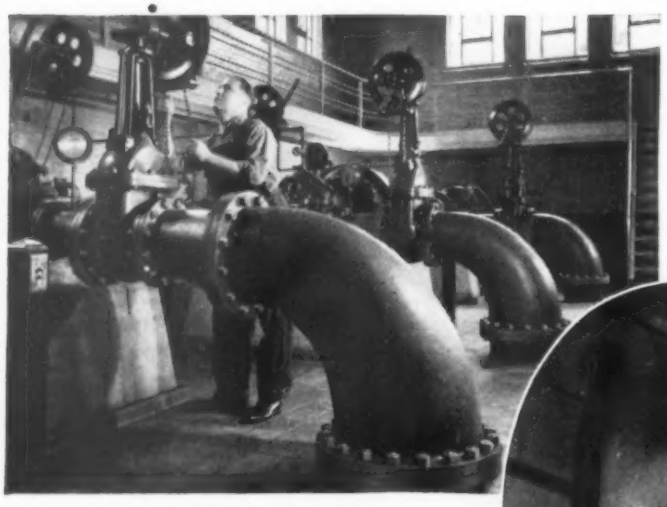
EAST COAST CITY depends on Allis-Chalmers motors. It's easy to see why — the Allis-Chalmers line of motors for public works ranges from one hp up to the largest size for all applications. A-C can also provide dryers, screens, sifters, roller mills and other processing machinery for sludge disposal.

Texrope and Vari-Pitch are Allis-Chalmers Trademark.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

Crane Valves do more than control flow



A SUBURBAN VILLAGE *waterworks equips with Crane. Shown are Crane 10-in. gear and chain wheel operated gate valves on high lift pumps.*

A. W. W. A. GATE VALVES BY CRANE *are assurance of complete compliance with newest specifications, and of the best valve performance in their class. Pattern No. 2495, illustrated, double disc, outside screw and yoke, flanged ends, comes in 2 to 24-in. sizes. See Crane Catalog supplement 3A, page 126.*

In water and sewage plants the country over, Crane valves do more than just stop and start flow. By doing that job precisely, they safeguard public health. By giving unusually long and faithful service, they hold valve maintenance, repair and replacement costs to the lowest level.

To the men responsible for public water services, Crane valves assure peace of mind under all working conditions. Wouldn't you feel safer with valves and fittings having a reputation for dependability through more than 90 years?

CRANE CO., General Offices: 836 S. Michigan Avenue, Chicago 5, Illinois. *Nationwide Service Through Branches and Wholesalers.*

A LARGE CITY *pumping station specifies Crane quality valves—gates, globes, angles, checks—from the smallest to the 36-in. motor-operated control valves to mains.*

VALVES · FITTINGS · PIPE

CRANE

PLUMBING AND HEATING

Chemicals you live by ...

Your guidepost to

HANDY CHLORINE

In your use of chlorine, the location of your source of supply is extremely important in getting delivery that you can count on. DIAMOND's four chlorine plants at strategic locations mean fast, uninterrupted service to most parts of the country. Single unit tank cars are shipped from all four plants; multi-unit tank cars, from all except Pine Bluff; 150-lb. cylinders, from Houston and Painesville only. For a reliable, year 'round source of chlorine, use DIAMOND ALKALI. Consult your nearest DIAMOND Sales Office or write direct.

DIAMOND CHLORINE

DIAMOND ALKALI COMPANY • CLEVELAND 14, OHIO

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More Than 250,000 HOMELITE UNITS

Pumps · Generators · Chain Saws · Blowers · Paving Breakers

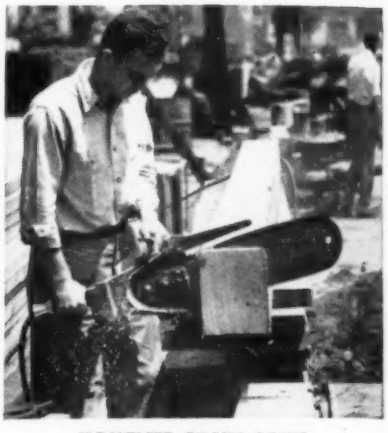
Are on the Job *Everywhere*

HOMELITE PUMPS

Everywhere . . . even in the most remote places . . . wherever water has to be pumped out fast *and with the least trouble* you'll find Homelite Carryable Gasoline-Engine-Driven Pumps in action.

HOMELITE GENERATORS

For operating electric tools . . . both high-cycle and standard 110 volt . . . and for operating floodlights, Homelite Carryable Gasoline-Engine-Driven Generators are the ever-ready, ever-dependable favorites everywhere.



HOMELITE CHAIN SAWS

Lightweight, compact, safe and easy to handle, these one-man, high-cycle electric chain saws have super-fast cutting power and are rugged and dependable for all types of cutting on both tree work and construction jobs.

HOMELITE PAVING BREAKERS

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HOMELITE BLOWERS

Where ejecting smoke or supplying fresh air is a must for safety and efficiency, Homelite Carryable Gasoline-Engine-Driven Blowers are constantly on the job.

HOMELITE SERVICE

In all parts of the country Homelite representatives are ready to demonstrate the advantages of Homelite units and to service most efficiently all Homelite equipment.

Homelite Corporation

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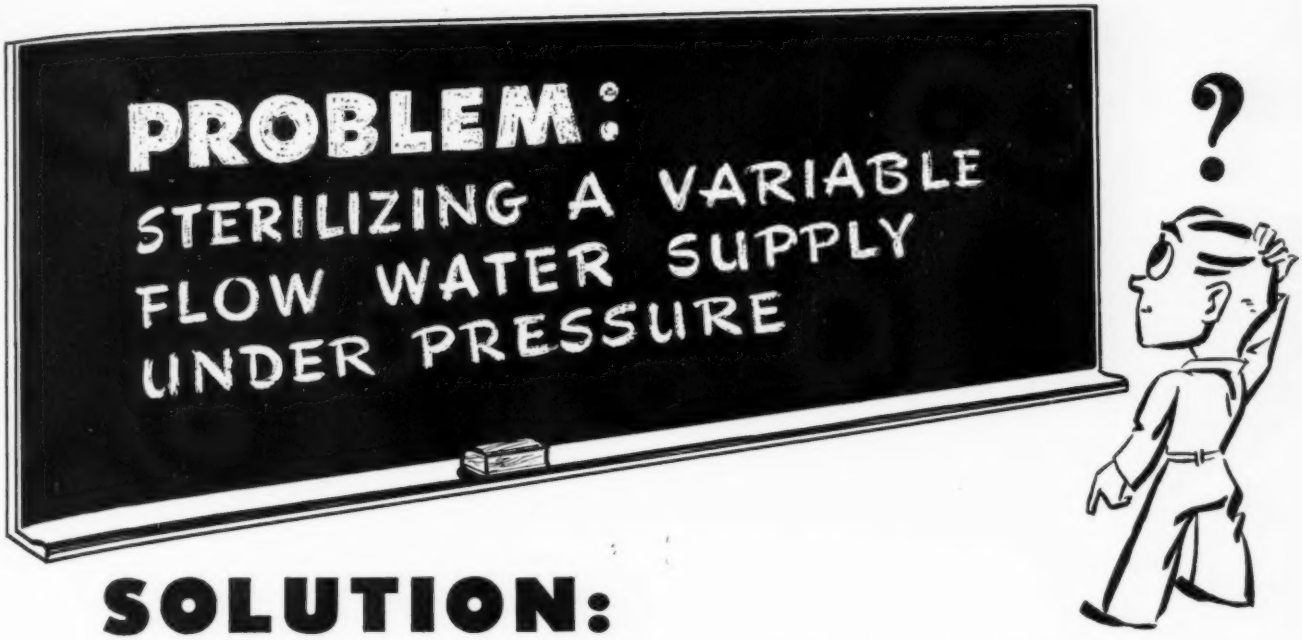
Manufacturers of
Homelite Carryable Pumps • Generators • Blowers • Chain Saws • Paving Breakers

See how Homelite Equipment can save time, trouble and money for you. Send for descriptive bulletins on any or all of the equipment shown above.



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Just install %Proportioneers% Automatic and Proportional Hydraulically operated Chem-O-Feeder and a standard water meter. It is only necessary to know the minimum, average, and maximum flow to be sterilized and the pressures against which the chemical will be injected. All flow is measured by the mechanical water meter and %Proportioneers% equipment starts, varies and stops dosage of chemical in step as the water comes on, fluctuates and tapers off. The %Proportioneers% Low Pressure Chem-O-Feeder shown is treating gravity water supplies against pressures up to 100 p.s.i. Installation is simple and our nearest sales and service representative will assist you in the selection of proper meter and equipment.

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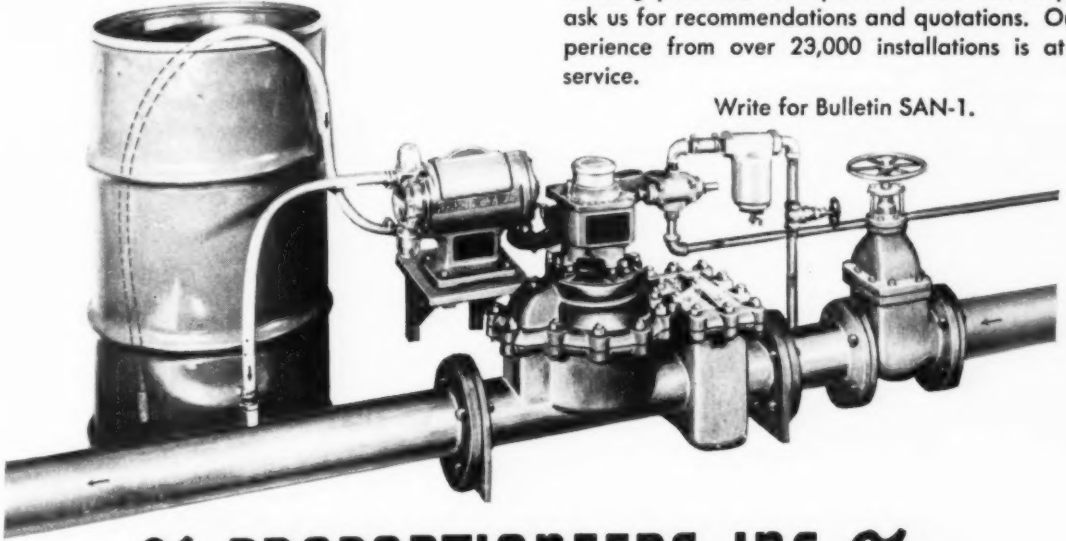
CONCLUSION: Whatever your water treating problem, %Proportioneers% can help you; ask us for recommendations and quotations. Our experience from over 23,000 installations is at your service.

Write for Bulletin SAN-1.



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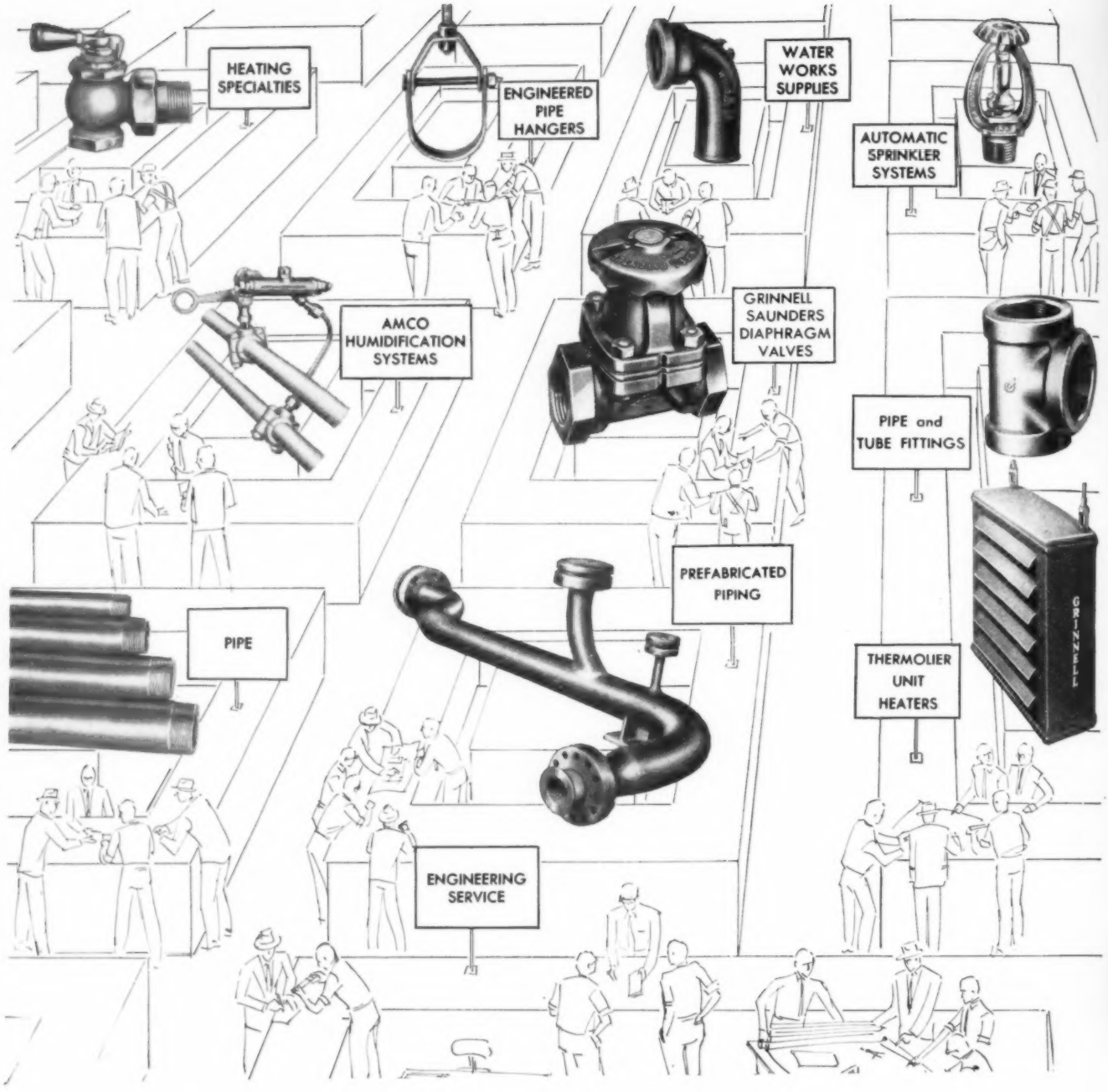

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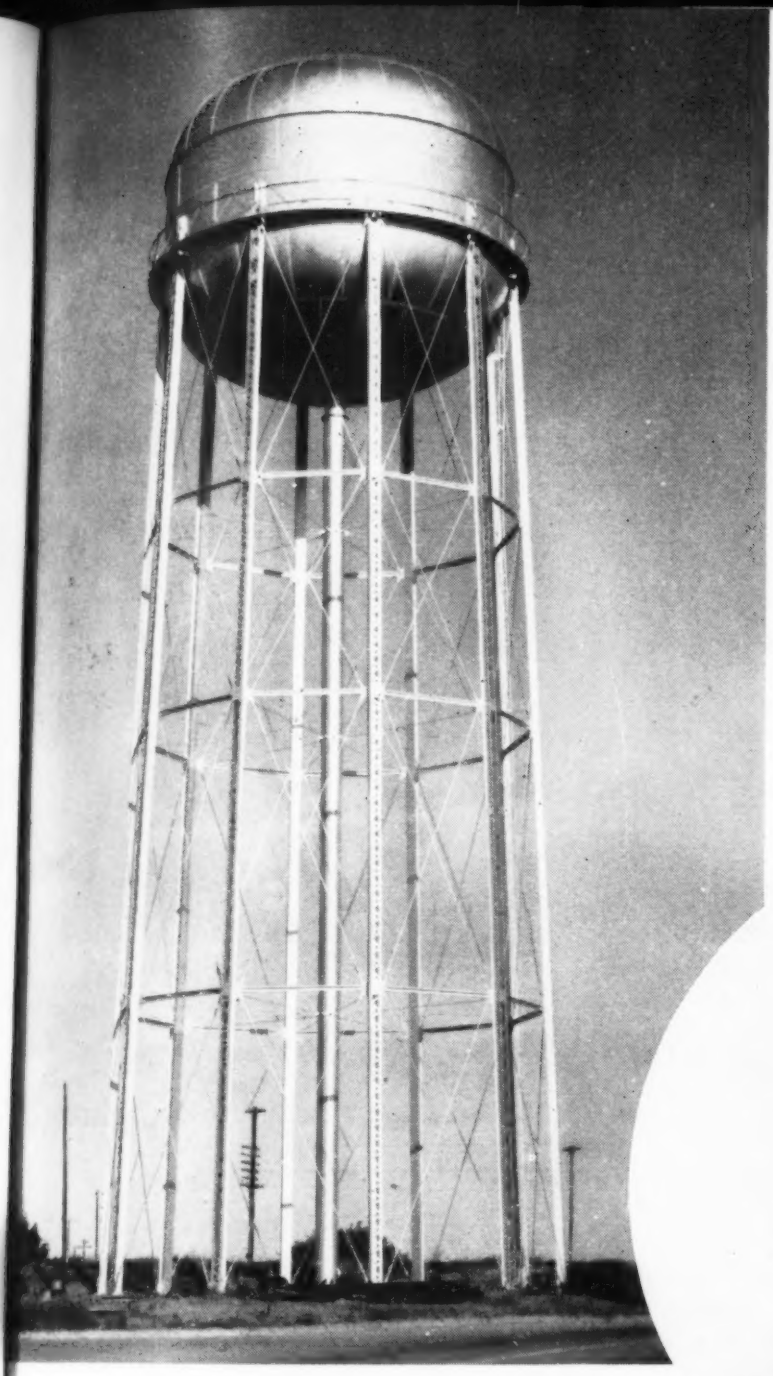

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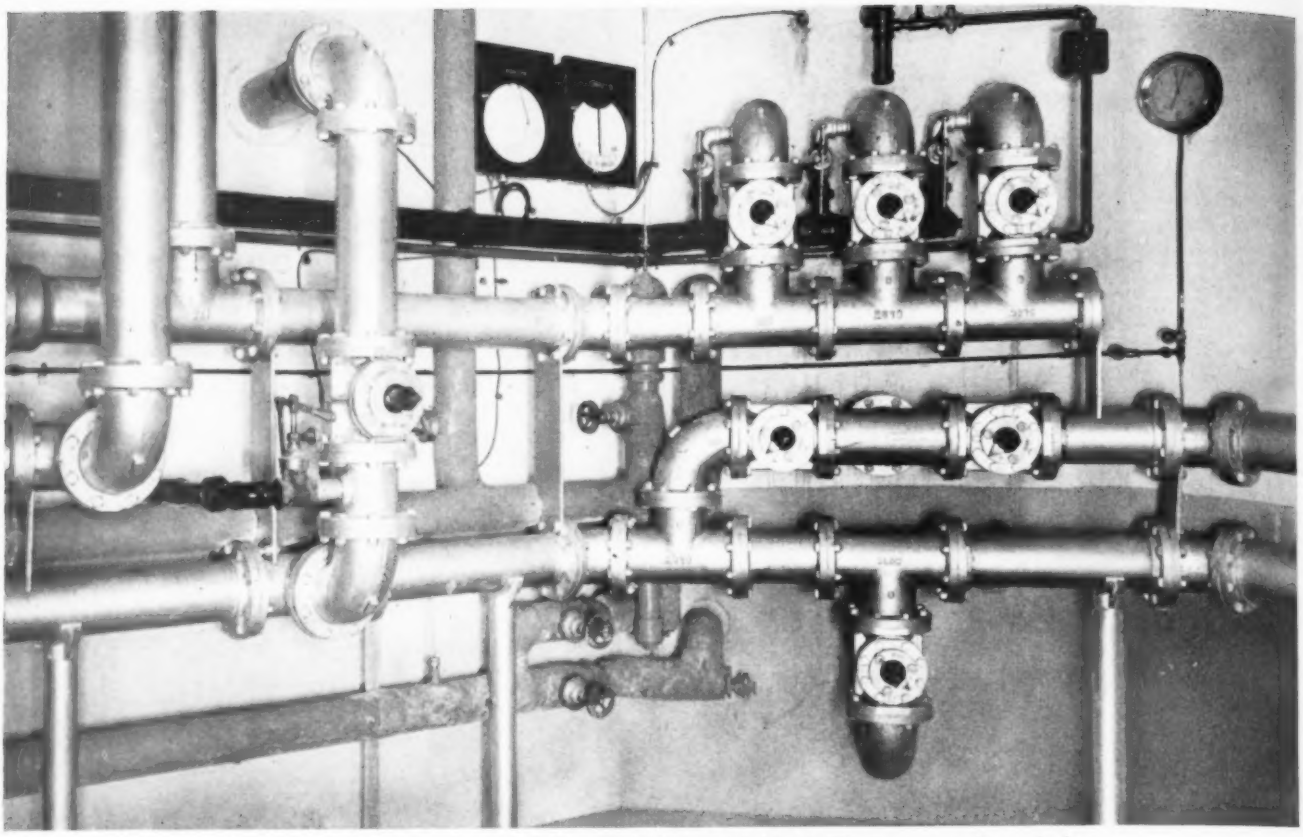

Nordstrom lubricated valves on sludge manifold in Rock Island, Illinois sewage disposal plant.

The most efficient valve for *SEWAGE DISPOSAL* has lubricated, tapered plug.

- NORDSTROM FLUSH PASSAGE-WAY PREVENTS SEDIMENT LODGING.
- THE TAPERED PLUG IS CONSTANTLY SEATED ON LUBRICANT.
- THE PORTS ARE SEALED BY "SEALDPORT" LUBRICATION SYSTEM.
- GLAND TYPE, FRICTION-FREE CUSHION PACKING INSURES LONGEST LIFE.
- THE LUBRICATED SEAT IS NEVER EXPOSED TO LINE CONTENTS.
- ROTARY PLUG MOVEMENT MAKES POSITIVE CLOSURE.

Fig. 142

Fig. 3465

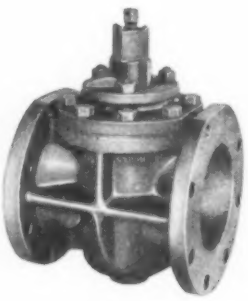

Fig. 143

Fig. 114

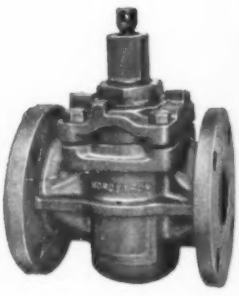

Fig. 115

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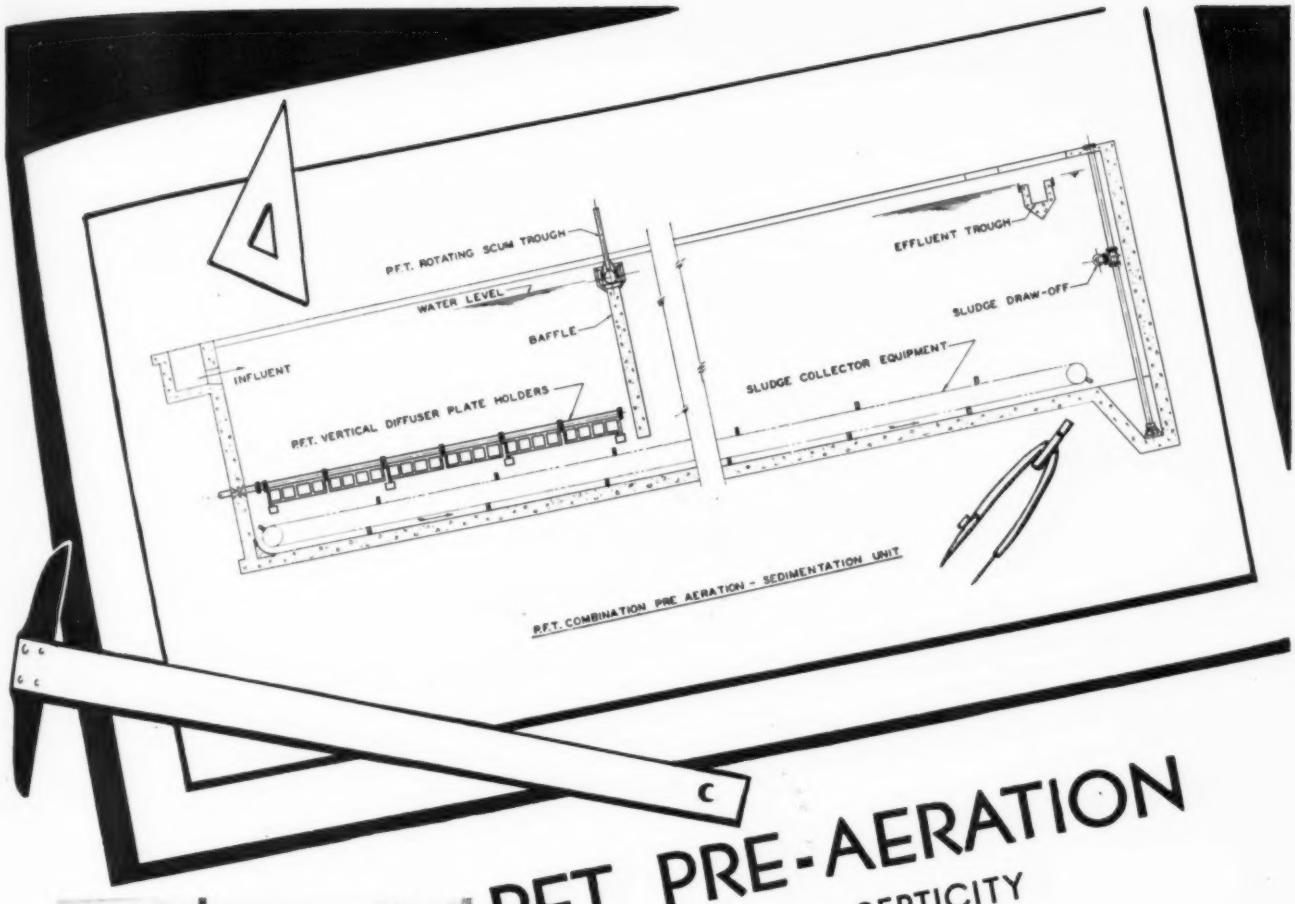

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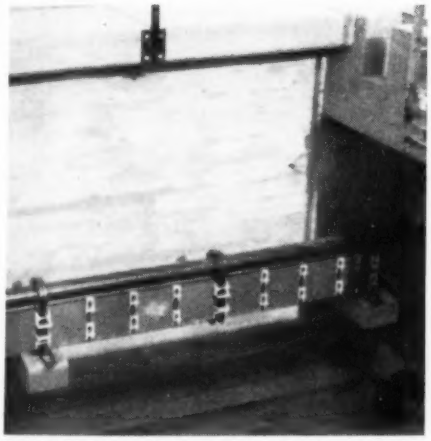

PFT Preaeration Equipment in Aeration-Sedimentation tank at Sewage Treatment Plant of the Central Contra Costa Sanitary District, Walnut Creek, Calif.—Clyde C. Kennedy, Consulting Engineers.

Here's real economy — the PFT way — in improving primary treatment and increasing settling tank removals. Combination Preaeration-Primary settling tanks are made possible by installing PFT Preaeration equipment in the inlet end of rectangular settling tanks. As shown in the diagram, this equipment is made up of standard porous diffuser plates in vertical cast iron holders arranged for easy removal and servicing of plates. Air introduced through these plates adds oxygen to the raw sewage and provides agitation and mixing. This triple action prevents septicity in the settling compartment and conditions solids for improved settling and a resulting increase in removal of suspended solids and 5-day B.O.D. A baffle wall separates the preaeration and sedimentation portion of the tank. A single sludge removal mechanism may be used for both the preaeration and settling portion of tank.

Recent PFT Preaeration equipment installations include: Marshfield, Wis.; San Leandro, Calif.; and Stockton, Calif. The North Point Plant for the City of San Francisco, for which contracts were recently awarded, also incorporates PFT preaeration equipment. Write for details.

P.F.T.

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Fairbanks-Morse Figure 5800 Double-Suction Single-Stage Centrifugal Pumps fit right into that pumping picture. In this application, two pumps direct-connected in series to a Fairbanks-Morse Diesel Engine deliver 12,000,000 gallons per day at 720 rpm. Single stage head ranges up to 305 feet . . . operating and maintenance costs range down to rock bottom. There is a Fairbanks-Morse Centrifugal to fit your pumping picture, large or small. Check your Fairbanks-Morse Pump Distributor or local branch office. Fairbanks, Morse & Co., Chicago 5, Ill.

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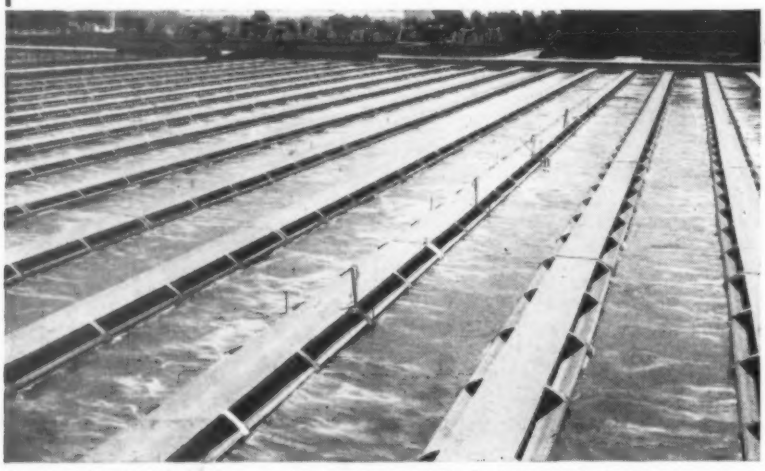
Performance in World's Largest Sewage Treatment Plant...

...leads to extended use of Everdur Electrical Conduit



Everdur Electrical Conduit serves the aeration and final settling tanks in bringing power from the operating galleries to the sluice gates of the control centers, and from these centers to the operating mechanism on the center pier of each tank.

General view of Southwest Treatment Works, Chicago, world's largest activated sludge sewage treatment plant.

WHEN Chicago's Southwest Sewage Treatment Plant was built twelve years ago, it utilized 14 miles of Everdur* Electrical Conduit, in sizes from ¾" to 2½". Conduit of Everdur Metal was selected because of its high physical properties and excellent resistance to many corroding agents.

More and more Everdur Conduit has gone into this plant, as its 1939 capacity of 400 m.g.d. had been expanded to 1,000 m.g.d. at mid-1948. Further expansion will take place over the next 5 years. Considerable Everdur Conduit is specified in several new contracts awarded to the Northern States Electric Company, Chicago.

For detailed information on Everdur Copper-Silicon Alloys in Sewage and Water Works service, write for Publications E-11 and E-5. 48188

*Reg. U.S. Pat. Off.

Everdur Electrical Conduit in service tunnel looking north from north gallery.

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NOW LOOK AT THIS *Speed-up*

1. Truck mounted, the mobile Hydrocrane moves easily through congested city streets—travels quickly from job to job.
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3. At the company yards the Hydrocrane handles miscellaneous lifting jobs.

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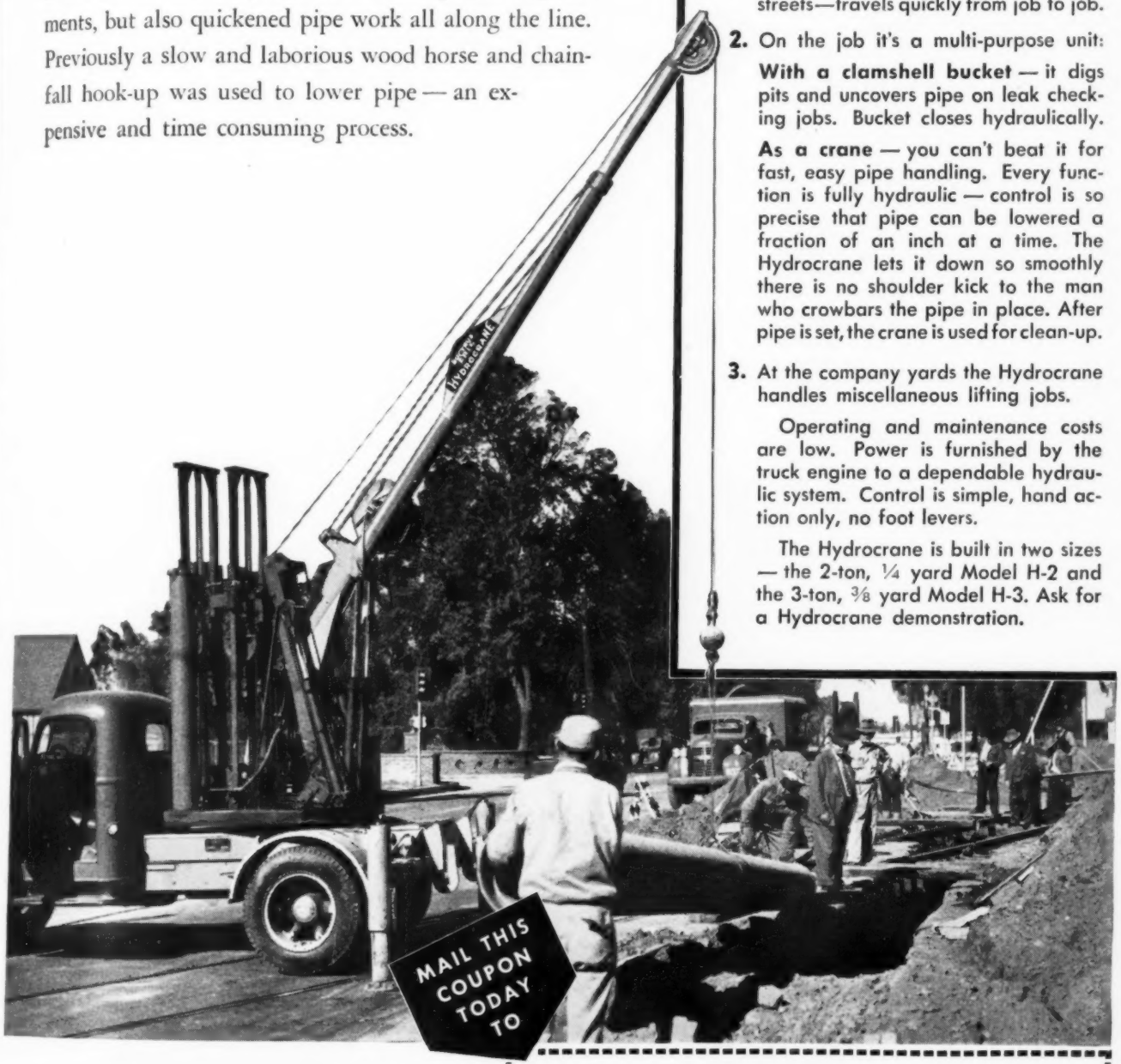
   The Hydrocrane is built in two sizes — the 2-ton, ¼ yard Model H-2 and the 3-ton, ⅜ yard Model H-3. Ask for a Hydrocrane demonstration.



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Installing a Dresser-Coupled steel line, even in hilly terrain, is simplicity itself. There's no bulky joining equipment to drag around, no field fabrication. You simply place the couplings over plain-end steel pipe and tighten the bolts. Any workman who can use a wrench can make a permanently tight joint every time.

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one of the LARGEST . . . but Modern

Completely equipped by Jeffrey in 1939, the Detroit sewage treatment plant is still one of the most modern and up-to-date in the country today. Rectangular sedimentation tank design was adopted since scale model tests demonstrated their superior hydraulic efficiency. Jeffrey primary collectors, bar screens, belt conveyors, screenings grinders, scum removers and grit collectors are all doing a good job of it . . . as in other large Jeffrey-equipped plants. Our Sanitary Engineering Division is prepared to offer information on our line of proved equipment and plant design.

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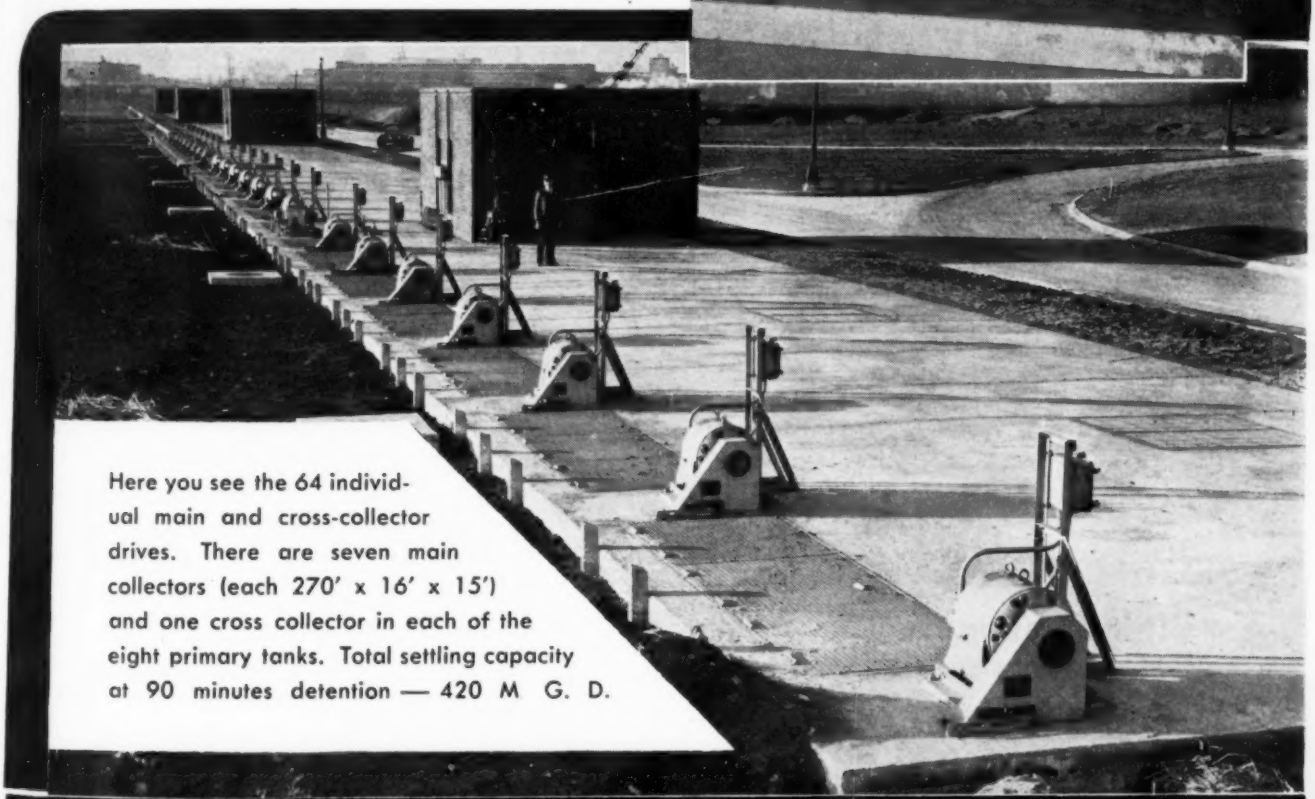
Right — view through one of the 270-foot main sludge collectors. There are fifty-six main collectors in the primary settling tanks. Space does not permit showing the six bar screens and the twelve grit collectors, designed for maximum flow of 900 M. G. D.



Here you see the 64 individual main and cross-collector drives. There are seven main collectors (each 270' x 16' x 15') and one cross collector in each of the eight primary tanks. Total settling capacity at 90 minutes detention — 420 M G. D.

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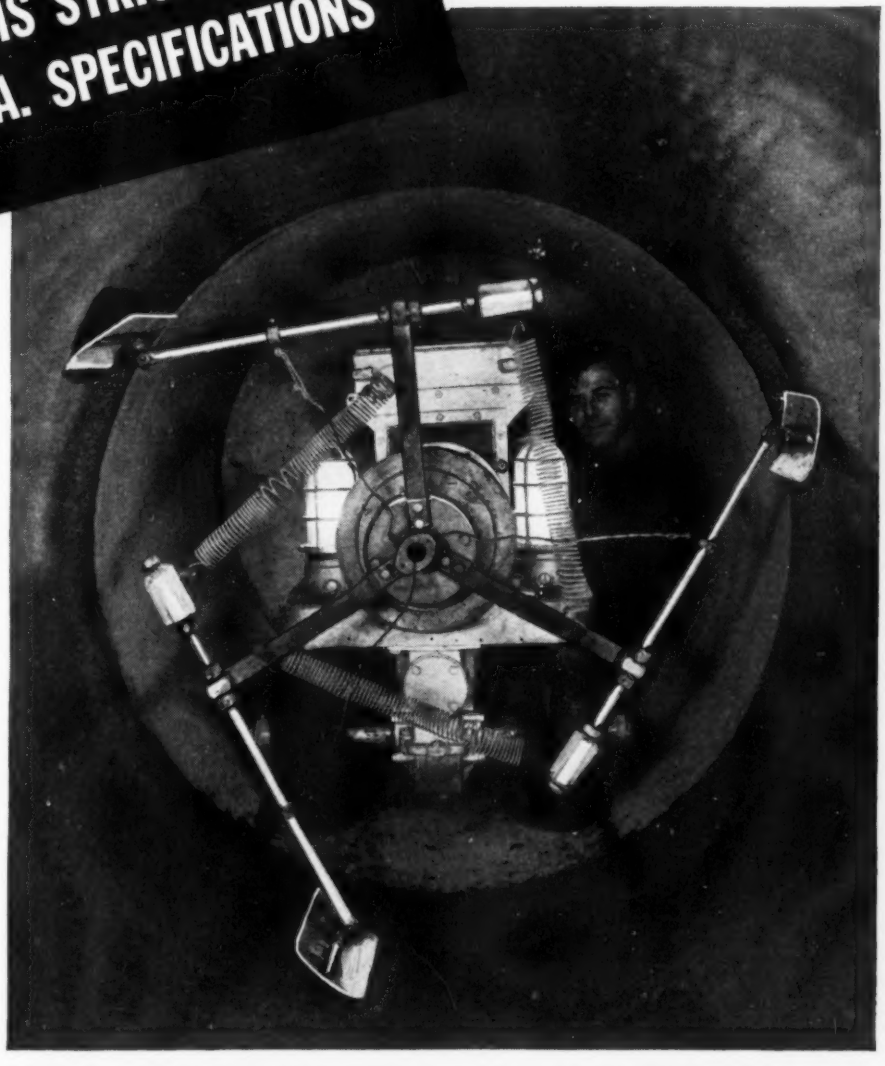

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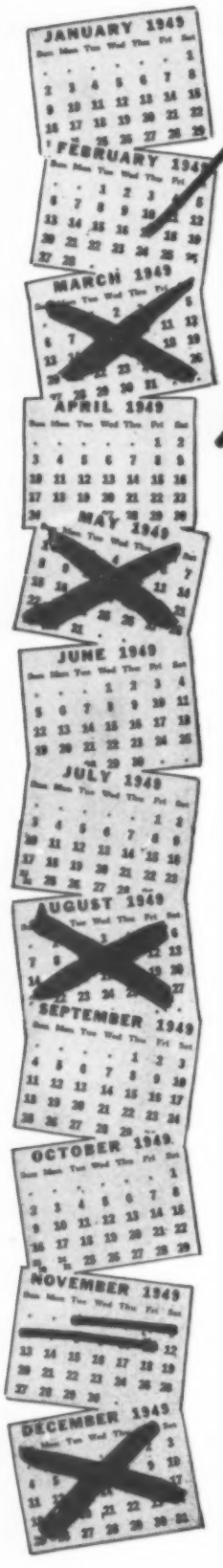

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WATER & SEWAGE WORKS

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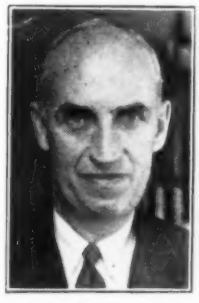
FLUORIDATION AS PRACTICED AT MADISON, WIS.

by
L. A. SMITH
Superintendent
WATER DEPARTMENT
MADISON, WIS.

IT WAS not so many years ago that it was discovered that fluorine compounds, particularly in public water supplies, caused those who drank the water to have unsightly mottled teeth. Health authorities and water utility operators at once began to examine the public water supplies for fluoride content in the areas over which they had supervision and to consider various methods of removing fluorine from water to eliminate this mottling of tooth enamel. I recall that it was discovered that the city water of Green Bay had approximately 2 parts per million of fluorine in the form of fluorides; whereas Madison had an almost negligible amount. We were congratulating ourselves in Madison upon the fact that this was a problem that we did not have to face and were feeling rather sorry for Green Bay, because it looked as if the fluorine compounds should be removed from the city supply.

It was not long, however, before it was found that while an excess of fluorine caused mottled teeth, fluorine in quantities of approximately one part per million apparently prevented tooth decay, particularly in children. It was further noted that mottled teeth were largely free of dental caries. A large number of tests and examinations of school children were made in cities where the public water supply contained fluorine and in other cities where it did not. The net effect of these examinations resulted in a belief on the part of many health authorities that fluorine in small amounts is desirable in public water supplies. In 1944, the health officer of the City of Madison asked



The Author

me when we were going to start treating the city water with fluorine for the purpose of preventing tooth decay.

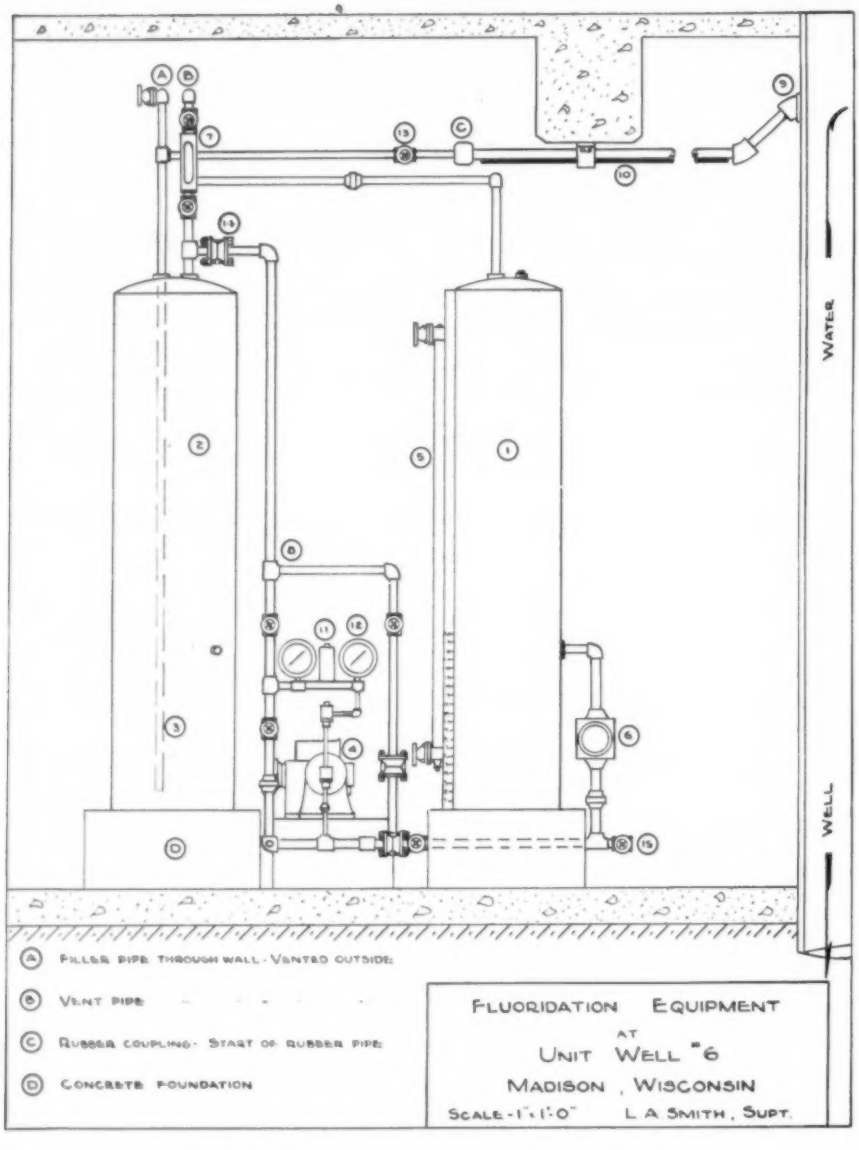
Fluoridation Considered by Water Board

The matter was taken up with the Board of Water Commissioners, where it was discussed thoroughly, and two conclusions were reached. First, that it was the function of the Water Department to furnish an ample quantity of pure water, under satisfactory pressure, for all domestic, industrial and fire protection purposes; but that the treatment of water to prevent tooth decay was a matter for the consideration of the health authorities. The second conclusion was that the Board of Water Commissioners would treat the water with fluorine if ordered by the City Board of Health and approved by the Common Council, with the express proviso that the cost of such treatment should be paid for by the city as a public health measure, rather than from utility funds.

The conclusions of the Board of Water Commissioners were transmitted to the Common Council and public hearings were held, the preponderance of opinion being that the addition of controlled quantities of fluorine to the city water would be advantageous. This conclusion was reached in spite of the fact that a committee consisting of doctors, dentists, members of the faculty of the University of Wisconsin in the field of medicine, toxicology, bacteriology, chemistry and biochemistry—as well as certain engineers and laymen—recommended that the City of Madison wait until the results of the fluoride treatment of water in other cities gave more definite information. Late in 1946 the Common Council ordered the Board of Water Commissioners to proceed with the treatment of the water supply of the City of Madison with fluorine at the rate of one part per million, and appropriated $15,000.00 to make a start on the project.

Fluoridation Not So Simple at Madison

The problem of treating Madison water with fluorine is somewhat different than in the ordinary city. In the average community the water supply emanates from a single source, whereas the City of Madison obtains its water from twelve deep wells, four of which furnish water to the Main Station, which is steam operated and where operating personnel is on duty at all times. The usual simple method of adding sodium fluoride to the water will be satisfactory at the Main Station. However, the other eight wells are separate unit wells, each one of which is a complete pumping plant, including well, reservoir, pump house



Sketch of Fluoridation Equipment, Madison, Wisc.

1. *30-gallon mineral oil tank.*
2. *40-gallon 60% HF acid tank.*
3. *HF acid filler and discharge pipe.*
4. *Micro-pump delivering oil to acid tank.*
5. *Oil tank gauge glass.*
6. *Low-level oil alarm.*
7. *Gas pocket and sight glass.*
8. *By-pass and oil return line.*
9. *Point of HF acid application to pump discharge.*
10. *Rubber discharge line feeding HF acid.*
11. *Pressure relief valve.*
12. *Pressure gauges.*
13. *Iron valves.*
14. *Bolted iron couplings.*
15. *Drain.*

(A)—Filler pipe through wall.

(B)—Vent pipe to outside.

(C)—Rubber coupling connecting ½ in. steel line to hard rubber feed line.

(D)—Concrete tank foundations.

and pumping machinery. The power at the Unit Wells is electricity and they are automatically operated, except for an inspection once in every eight hours. For this reason, the application of fluorine at the Unit Wells must be automatic.

It became clear early in the consideration of this problem that it would be better to have the fluorine compound in liquid form for automatic operation. The fluoride compound which is the easiest to handle and obtain is the salt, sodium fluoride. The available fluorine content of this salt is 45½% and it is soluble in water to 4% by weight. For practical purposes, it was deemed advisable to limit the solution to 3½% by weight, or about .3 pounds per gallon of water. A solution made up of 3½% sodium fluoride by weight would have a concentration of 16,000 parts per million of fluoride ion. Of this solution, 64 gallons would be required to treat 1,000,000 gallons of water. Hydrofluoric acid, on the other hand, provides in liquid form a comparatively concentrated form of fluorine. To treat 1,000,000 gallons would require only about 1.67 gallons of 60% hydrofluoric acid, so this was selected.

Unit Well No. 6, which was selected to make the initial installation, has a capacity of 3,000,000 gallons per day. It is equipped with a motor-driven deep well pump, which pumps the water into a covered surface reservoir of 100,000 gallons' capacity, from which it is pumped into the distribution system with a horizontal centrifugal booster pump. It is desirable that the booster pump operate continuously. It is impossible to synchronize the deep well pump with the booster pump because the pressures vary in the distribution system, thus causing variations in the rate at which the water is pumped. To eliminate this difficulty, the deep well pump has a capacity of 3,200,000 gpd. and the horizontal booster a normal capacity of 3,000,000 gpd. The deep well pump operates until the surface reservoir is full, when it is shut down automatically by a float switch until the water in the surface reservoir has dropped to a pre-determined level, after which it starts again.

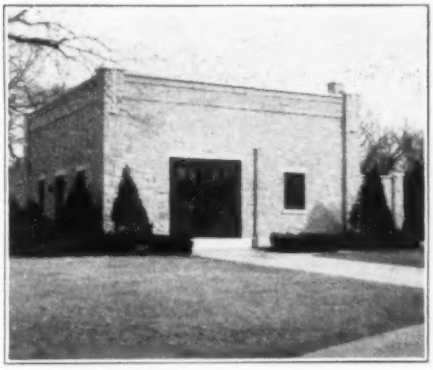
Hydrofluoric Acid Handling and Feeding

The 60% hydrofluoric acid solution is available commercially in 20-gallon steel drums. This acid is extremely corrosive and no pump is available commercially for handling it. In order to reduce corrosion to a minimum and to proportion the acid accurately and safely, a specially designed system is required. These facts led to the adoption of the displacement method of feeding the acid. This consists of pumping liquid into a closed vessel containing a second liquid, thus displacing the second liquid at the rate the first one is being pumped. In this case, the displacement fluid must be of a quite different density and not react with hydrofluoric acid. Russian mineral oil was selected because it has a specific gravity of 0.9 and does not react with hydrofluoric acid, which has a specific gravity of 1.2. The fact that hydrofluoric acid is shipped in steel drums, some of which have been used many years, indicates that ordinary steel would be suitable for the construction material. Corrosion tests show that the penetration of steel by 60% hydrofluoric acid will not exceed .03 of an inch per year at normal temperatures and with little or no agitation. The corrosion is even less than this when the steel has been pacified by reacting it with 60% hydrofluoric acid containing 2% sulphuric acid. All of the materials se-

lected, including tanks, pipe fittings and valves, were of extra heavy construction to increase their life under normal rate of corrosion.

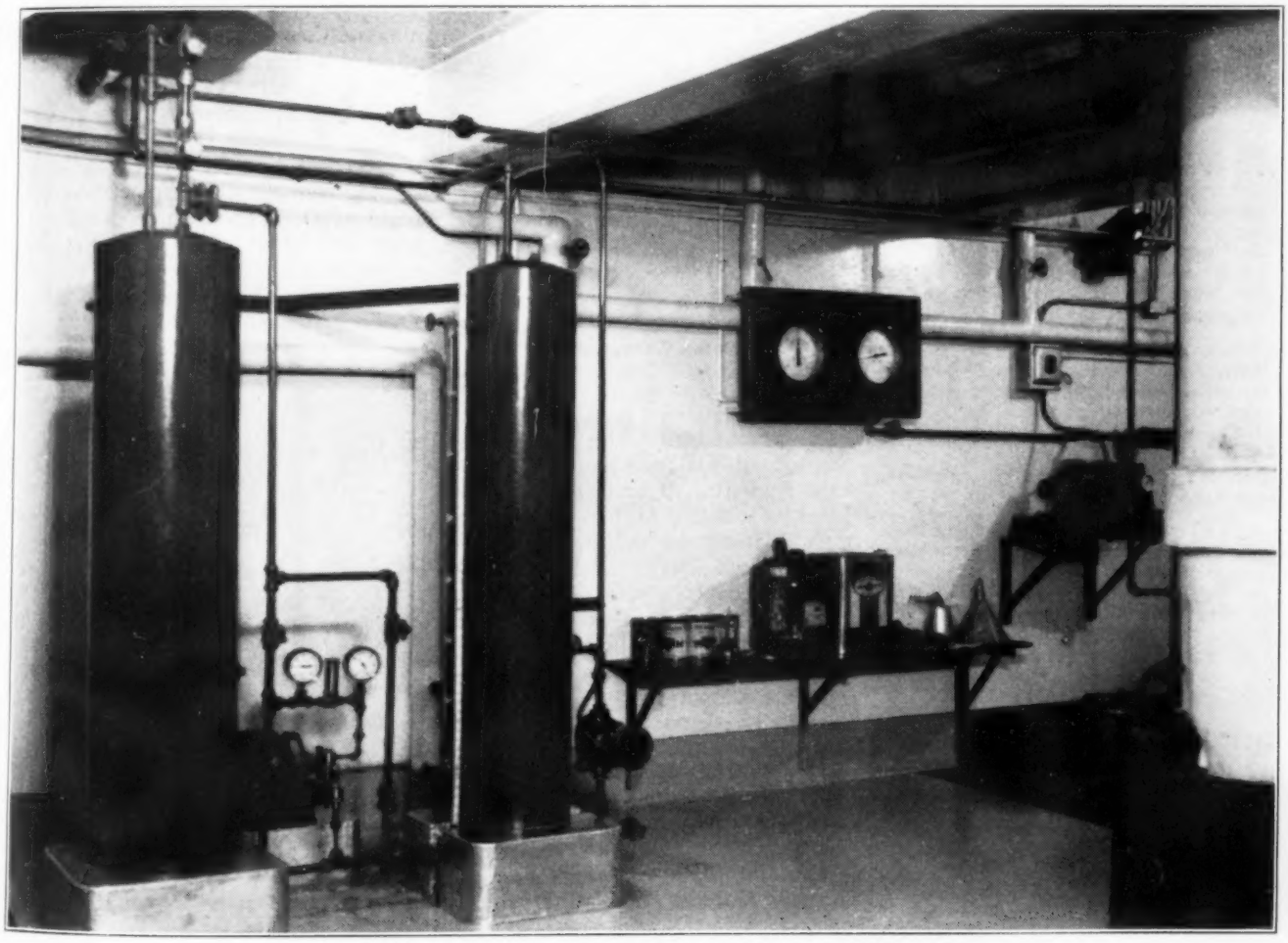
Design of the Feeding System

In essence, the feeding system is as follows: Two tanks are used—one a 30-gallon tank and the other a 40-gallon tank—between which is located a motor-driven micro - pump — see sketch. The quantity of hydrofluoric acid necessary to treat 3,000,000 gpd. of water, which is the capacity of Unit Well No. 6, is 5 gallons, or 0.21 of a gallon per hour. The 30-gallon tank (on right in sketch) is filled with white Russian mineral oil and the 40-gallon tank with 60% hydrofluoric acid. The mineral oil is pumped from the 30-gallon tank into the 40-gallon tank, which has an inlet at the top for the lighter gravity mineral oil. The discharge of the 40-gallon tank is through a pipe line which extends down to the bottom of the tank. When the oil is pumped into the 40-gallon tank, it floats on top of the acid and forces the acid upward through the riser and through a pipe directly into the eduction line of the deep well pump, which discharges into the surface reservoir. This point of application was selected for two reasons. First, the maximum of mixing occurs and, second, the amount of fluorine in the water can be checked at any time before it is pumped into the distribution system. It was considered desirable to have the oil tank smaller than the hydrofluoric acid tank to make certain that no mineral oil will ever be discharged into the public water supply.

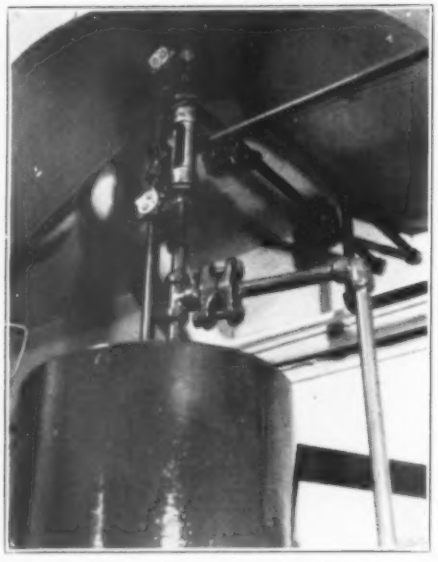


Unit Well No. 6. Pump House
(Clear Well Receiving Fluorinated Water in Rear)

The controls on the motor-driven micro-pump are interlocked with the controls of the deep well pump in such a way that when the deep well pump starts, the micro-pump also starts; and when the deep well pump automatically shuts down, the micro-pump stops. While 60% hydrofluoric acid does not attack steel to any appreciable extent, when it is diluted it becomes extremely corrosive. When the initial installation was made, the hydrofluoric acid was introduced into the eduction line of the deep well pump through ordinary ½-in. steel pipe. A nipple and a bushing at the point of discharge rapidly corroded and failed within two weeks. It was quite clear, therefore, that some other material than steel would have to be used for the discharge line. After considerable investigation, it was found that the materials which are most suitable for this purpose are teflon, hard rubber, and ammonial lead. Because of the difficulty of getting teflon promptly, hard rubber was substituted for the original steel line. The ½-in. steel pipe was replaced with hard rubber pipe, fittings and bushings, in June, 1948, and the unit has operated satisfactorily to date. It was noted that while the hard rubber pipe did not leak, it became so



General View of Fluoridation Equipment, Unit Well No. 6, Madison, Wis.



Gas Pocket, Sight Glass and Vent Pipe to Outside from Acid Tank

soft that it could be easily bent. In order to prevent it from sagging out of shape, it was supported with a small channel iron. There are several auxiliaries to the basic system, as outlined above, which may well be noted:

1—The 30-gallon tank is equipped with a sight gauge glass so that the quantity of acid in the system can be computed. There is also a low-level float alarm which lights a red light on the switchboard when the amount of acid in the system drops below a 24-hour supply.

2—A gas pocket and sight glass are placed on top of the acid tank. The action of the acid on steel produces hydrogen and by keeping the sight glass full of oil, it is possible to note any gas formation, indicative of corrosion. At the time the plant was originally put in service, a few bubbles of hydrogen accumulated; however, there has been no evidence of corrosion since then.

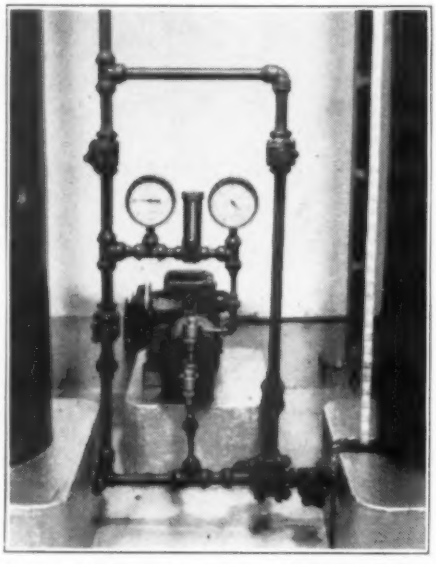
3—Proper relief valves, back-pressure valve, and bypasses are provided so that the equipment will not be damaged by excessive pressures, nor can the acid be siphoned into the water system should vacuum conditions prevail in the eduction line from the deep well pump—see sketch and key.

4—The pipe lines connecting the two tanks with each other, and with the micro-pump, are so arranged and valved that when the supply of hydrofluoric acid is replenished the Russian mineral oil is forced back into the 30-gallon tank. Diaphragm valves are used throughout the entire system to eliminate packing problems on both the acid and oil lines.

Method of Operation

The method of operation is as follows: The filler line (A) to the 40-gallon acid tank extends through the wall of the building to another 40-gallon storage tank. When this tank is filled, sufficient acid is available to last slightly over one week. To enable the drum in which the acid comes to be handled easily, a cradle-type of stand was built, equipped with rollers. The drum of acid is placed on this stand, the plug removed and a fitting —consisting of a nipple in a tapped plug, a valve, and a half-union—is screwed into place. The drum is then rotated and the half-union on the drum fitting joined to the half-union on the storage tank riser. By opening the valve, the acid flows by gravity into the acid storage tank because of the difference in head between the acid tank and the acid drum. By operation of the proper valves, the Russian mineral is forced back from the 40-gallon tank into the 30-gallon tank so that normal operation can be resumed.

The proportioning pump is adjusted so that it has a discharge capacity of 0.21 gallons per hour. When it is operated, this quantity of oil is pumped from the oil tank into



Micro Oil Transfer Pump, Pressure Relief Valve, Gauges, etc.

(Oil Tank Sight Glass on Right, Acid Tank on Left. Note Pinch-Type Diaphragm Valves Used Throughout.)

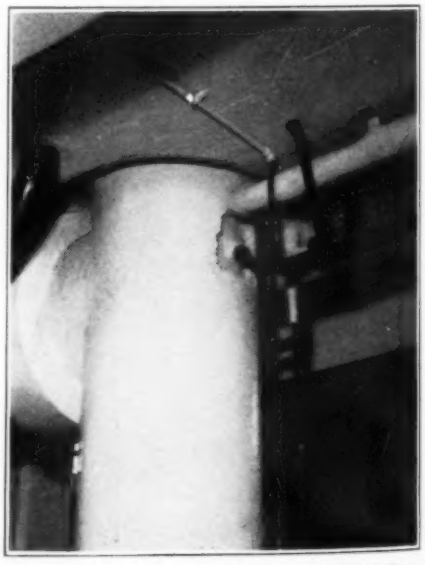
the top of the acid tank. An equivalent amount of acid is then being forced from the bottom of the acid tank upward through the riser and into the feed pipe to the water system. The system is automatic in that it starts and stops with the deep well pump, so that when the micro-pump is operating it is always delivering an accurate proportion of acid into the water. The supply of acid is replenished during the period in which the deep well and micro-pumps are shut down. Thus, the fluoridation of water is continuous while the well pump is operating.

Dosage Held to 1.2 Ppm. Fluorine

The State Health Department permits fluorine to be applied at a rate not to exceed 1.2 ppm. and this is the dosage adopted. Apparently fluorine is different from chlorine when added to water. When chlorine residuals are checked in the distribution system the proportion of chlorine is much less than the proportion originally applied. However, when hydrofluoric acid is added to water there seems to be no such reaction, as residual tests of the water in the distribution system show that the initial dosage is retained throughout the system.

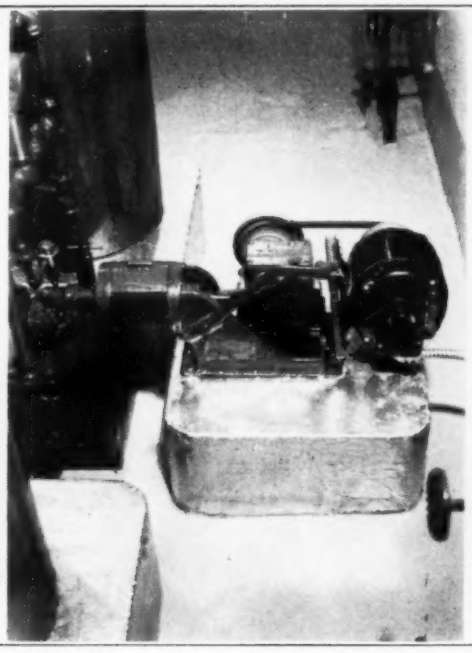
I wish to acknowledge, at this time, the valuable assistance rendered by L. F. Warrick, State Sanitary Engineer; Dr. M. Starr Nichols, Director of the State Laboratory of Hygiene; and Mr. Roy C. Olson, Engineer for the Klenzade Products, Inc., who was largely responsible for the design of the system and the selection of materials to be used.

At the outset, the citizens of Madison were somewhat apprehensive as to the possibility of fluorine affecting the taste of the water or affecting its use in watering flowers and plants and in fish bowls. Manufacturers of beer and soft drinks also indicated their concern as to the possible adverse effect in the manufacture of their product. The dosage is so small that none of these water uses is adversely affected by the fluorine treatment. The total daily pumpage in Madison is 12,000,000 gallons so that only 25 per cent of the water is being treated at the present time. Most of the calls coming into the Department now are with reference to when the additional units will be added so that all of the water will be treated. Four of the Unit Wells, together with the Main Station, furnish over 95 per cent of



Connection of Hard Rubber Acid Feed Line Into Well Pump Eduction Line

Hydrofluoric Acid Drum
Note cradle rollers for easy turning of drum and connection for emptying.



Side View Proportioneer's Micro-feed Pump
Cuts in and out automatically when well pump goes into or out of operation.

Charging Acid Tank from 20 Gal. Drum
Note protective garb worn by employees and emptying connection coupled up.

the water. We hope to complete the installation on the other three Unit Wells and the Main Station sometime in 1949; in fact, all of the material for Unit Well No. 7 is on hand and this installation should be completed early in 1949.

It is too early to determine what the actual cost of treating the water with fluorine will be in Madison, although it will probably be approximately 25 cents per capita per year. This compares with approximately 10 cents per capita per year in the ordinary plant using sodium fluoride, and where the water supply is furnished from one central system.

Alfred Norris Becomes Vice Pres. & Gen. Mgr. Indianapolis Water Co.

Alfred O. Norris, general manager of the Birmingham (Ala.) Water Works Co. since 1940, has been elected vice-president and general manager of the Indianapolis Water Co., Indianapolis, Ind., according to an announcement of March 4. He succeeds Howard S. Morse, vice-president and general manager of the company since 1925, who becomes executive vice-president and will continue on the board. Mr. Norris was also elected a director, and it is understood that he will assume administrative direction of the company, and that Mr. Morse will have general policy supervision.

Norris, who will assume his new post in April, has held several executive posts with the American Water Works & Electric Co., of which the Birmingham plant is a part. In 1929 he became assistant to the manager in the New York office of American and during the period 1936-1940 was an executive of the Cuban Water Co. in Havana.

Among the more recent major improvements in the Indianapolis system under Mr. Morse, have been the construction of the 7,000,000,000-gallon Geist Reservoir on Fall Creek, the White River Filter Plant, elevated tanks near Butler University, the Fall Creek plant in Irvington, and the West Side and South Side Booster Pumping Stations.

—Don Wimmer.

U.S. P.H.S. Enlarges Pollution Research Program

According to an announcement by Mark D. Hollis, Asst. Sur. Gen., U.S. P.H.S., the biological phases of the pollution research program of the Environmental Health Center at Cincinnati are being enlarged. The research is being centered in the Biology Section of the Center's Research and Development Division and is to be carried out under the direction of Senior Scientist S. M. Tarzwell.

Both laboratory and field studies will be made. The proposed studies are grouped under three subsections. The first will be concerned with problems of water supply and the role of algae and other plankton in waste treatment and stream purification. The second subsection will study organisms in muds and bottom deposits and the effects of industrial wastes on these organisms. The third subsection will carry on bio-assay studies on the toxicity of various wastes to fishes.

The Environmental Health Center was formerly known as the Water and Sewage Investigations Station. It is under the immediate supervision of Sanitary Engineer Director Vernon G. Mackenzie. The Research and Development Division is directed by Head Bacteriologist C. T. Butterfield.

Los Angeles Water Dept. Keeps Abreast

A measuring mark for the City's growth was furnished by the Water Department of Los Angeles at the close of 1948, when it was announced that new water services during the year averaged 1650 installations a month as compared to 500 a month in 1941. Water main installations, including both new extensions and replacements necessitated by increased demand, averaged more than 60,000 feet per month during the past year. The comparable figure for 1941 was 22,000 feet.

MAINE WATER UTILITIES ASSOCIATION MID-WINTER MEETING

Annual Meeting at Portland, Maine, Feb. 8-9

THE 141ST conference of the Maine Water Utilities Association was held at Portland, Maine, on February 8-9. This was the 23rd meeting at Portland, and represented the annual mid-winter meeting and

V. President
S. S. Anthony
Supt.
Augusta, Me.

Secy.-Treas.
Earl Tarr
Supt.
Winthrop, Me.

exhibit, held at the Douglas Street Service Building of the Portland Water District.

Clam Chowder Supper

For the 19th consecutive year, the Portland Water District was host at its famous Clam Chowder Supper. 250 persons were served in the dining room on the second floor of the service building. The popularity of this annual meeting has grown to such an extent that there are now a great number of Massachusetts members of the Maine Water Utilities Association, and Vice-President S. S. Anthony, Superintendent of the Augusta Water District, commented that before long there would be a Boston Section of the Maine Water Utilities Association.

Following the Clam Chowder Supper, there was entertainment by a magician and a trio of girl singers from Falmouth, Maine.

Exhibits

Each year the Portland Water District provides tables for exhibits by various water works manufacturers and jobbers. This practice has grown so popular in recent years that at this meeting there were 39 exhibitors, showing all kinds of wares, from those usually associated with water treatment, such as meters, valves, fittings, chlorinating machines, and jointing compounds, to such items as are usually not recognized as having such great use in water works maintenance and repairs.

These latter included such things as trench pumps, chain hoists, burners, wrenches, dip needles, flashlights, pipe jacks, paving breakers, air compressors, paints, fire and safety equipment, power tools, explosives, and many other items.

Business Session

Following luncheon on Wednesday, a short business session of the organization was held, at which time it was voted to give retired active membership to Harry U. Fuller of Portland, Charles Bowker of Brunswick & Topsham Water Dist., and J. H. Woodward of Fryeburg. John P. Carey of Bath reported for the legislative committee and brought out the problem which has confronted at least one city, where a state highway called for an underpass. This necessitated a complete relaying of the main, at a cost of some several thousand dollars, borne by the local municipality. The committee wanted a revision of the state law to make the Highway Commission pay for such main relaying, caused by changing present highways. Mr. Carey raised the question, "Why should local municipalities pay for an improvement which was of state or national benefit?"

Lowering Cast Iron Water Main

A short paper on "LOWERING OF A 30 IN. CAST IRON WATER MAIN AT PLEASANTBROOK" was presented by Milton Thorne, Supt., Portland Water District, following the Clam Chowder supper on Tuesday night.

This 30 in. cast iron pipe was 5,355 ft. long, and in addition, there were 1,838 ft. of 24 in. cast iron, cement-lined pipe. Eighty per cent of the 30 in. pipe had been in service since 1903. A 12 ft. length of this pipe weighs 5,600 lb., and is 1⅜ in. thick. It was removed, cleaned and cement-lined a number of years ago. The pipe had to be lowered 250 ft., plus 185 ft. of new line to a new industrial building. The work was done by hand labor—a trench 7 to 8 ft. wide and 8 ft. deep and 435 ft. long was dug—a total of 1,000 cu. yds. of material was excavatel, the excavating being done for the entire width down to the pipe.

Below the pipe the excavation was made and timbers were placed at the joints; then the earth was cut away beneath the pipe and lowering proceeded. During the lowering, only two leaks developed. There was a slight seepage when the pipe was being moved down, but after placement the seepage was taken up. Pressure was maintained throughout the entire period.

Hosts
Portland Water District

F. J. Remy
Treas. &
Gen. Mgr.

H. Burgi, Jr.
Ch. Engr. &
Asst. Gen. Mgr.

It cost $3,500 to excavate, lower the pipe and backfill the trench. This was at the rate of $8 per foot. It is equivalent to a common trench 5 ft. deep for $1.10 per foot. Mr. Thorne said that this type of lowering work could be accomplished anywhere, and he referred to previous articles which he had written in the *Journal of the Maine Water Utilities Association*, Vol. 13 and Vol. 22.

Corrosion Control

"CORROSION CONTROL WITH CALGON" by J. H. White, Chemical Engineer of Calgon, Inc., Boston, Mass., was the second paper on the program and was presented immediately after the noon dinner on the second day of the meeting.

Mr. White spoke of the corrosive properties of water and the various items which affect these corrosive properties, such as pH, oxygen concentration, temperature, dissolved salts, etc. To offset the corrosive action of water, Mr. White said alkali could be added, either lime, or soda ash, but even when the alkali was added, the presence of oxygen would cause tuberculation. Therefore, some other method should be sought.

As to other methods of preventing corrosion, Mr. White suggested that for small installations copper pipe, or tin-lined pipe could be used. On larger pipes lining of the pipes is the answer to corrosion prevention. Most pipes in use today are lined, new pipes gen-

erally being lined with bitumastic paint, and many old pipes being cleaned and lined in place with cement.

The use of Calgon is also a lining process, because the Calgon deposits a thin film inside the pipe. It not only protects all sizes of pipes and all branches, but also protects the consumer's piping, as well.

When Calgon was first introduced a number of years ago, it met with both enthusiasm and doubt—enthusiasm at its effectiveness and doubt that so little material could do so much. During the war Calgon was not available to the extent desired, but at the present time there is plenty available for all uses.

The average dose of Calgon required is two parts per million, or 16.6 lb. per million gallons. Where the flow in the pipes is sluggish, a higher dosage is to be used. It is possible to calculate the amount of Calgon needed by knowing the total surface exposed in the piping, but this calculation is difficult because of tuberculation, which must be taken into account in estimating the total surface exposed.

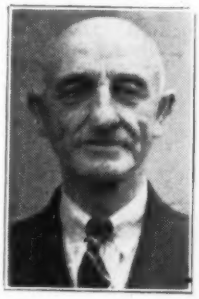
In starting any system with the use of Calgon, it is recommended that the system should be first flushed and then a 10 ppm. dose of Calgon added. Calgon, which is a hexa-meta-phosphate, will protect iron surfaces down to a pH of 5.0. The compound is less efficient below that pH and if waters have a pH of less than 5.0, lime or soda ash should be added to raise the pH.

Tests for Calgon should be made at the ends of the system, where a concentration of at least 0.5 ppm. should be maintained. At the beginning of any operation on a new system, where Calgon is used for the first time, tests should be made more frequently than are required later. In as much as the equipment, although relatively inexpensive, has little use after the operation has become established, the company recommends that a local laboratory do the testing, rather than that the water utility buy equipment for determining the content of Calgon.

To determine the corrosivity of a water, Mr. White recommends the setting up of a test system such as was demonstrated at this meeting. Two glass tubes of large diameter are filled with steel wool and plugged with glass wool. Water is run into both tubes. One tube receives untreated city water and the other tube receives water treated with Calgon, or, in this case, Micromet, which is a slowly soluble form of Calgon. The extent of corrosion can be shown by weighing the dried steel wool after exposure.

One means of testing the corrosivity of the water is to determine the dissolved oxygen at the beginning of the system and the dissolved oxygen at the end of the system. If the dissolved oxygen decreases, there is obviously a corrosion taking place.

If the water supply contains dissolved iron, its precipitation and its effect on taste might be prevented by adding Calgon in proportion to the iron content. This treatment can also be used to hold manganese in solution. For industrial waters the company recommends the use of two parts of Calgon to one of iron or manganese, and for domestic water systems they recommend four parts of Calgon to one of iron or manganese. The addition of Calgon does not change the alkalinity or hardness, but does prevent scale formation, corrosion and red water. It is also believed to improve the taste of the water by the prevention of corrosion of the iron and the formation of tubercules, etc.



Program

M. Thorne
Supt.
Portland, Me.

T. R. Camp
Cons. Engr.
Boston, Mass.

Mr. White said that, in some cases, there had been noted an improvement in the flow coefficient of water mains following the treatment with Calgon. This is believed to be due, over a period of time, to shrinkage of the tubercule, wherein the red oxide of iron is converted to the black magnetic iron oxide, which has a smaller volume. Studies on this matter are still under way.

Water Tank Maintenance

"Water Tank Maintenance" was the title of a paper presented by Whitworth Stokes of the Dixie Tank and Bridge Co. of Nashville, Tenn. In beginning his paper, Mr. Stokes reviewed the history of the controversy relative to the Dixie Tank and Bridge Co. and Elevated Tank Maintenance, which has been before the water utilities industry for a number of years.

Mr. Stokes reviewed his side of the story from 1943 on and went into the details of various articles which have been published, various suits on both sides, which have been settled, and questions of contract form, which are being resolved between the company and the A.W.W.A.

According to Mr. Stokes, the company has had an enviable record in dealings with its customers and has prepared a form of contract which is believed to be acceptable to the American Water Works Association and expects no further controversy to exist on this matter.

In the second half of his presentation, Mr. Stokes discussed tank maintenance practice. With the exception of whether there should be a scaling of the tank before inspection, there has been a meeting of minds on what constitutes good practice. Mr. Stokes stated that arc welding is used on seams, rivets and thin plates. Reriveting is no longer the best way; it is too expensive, and acetylene torch welding is not proper because it causes the plates to buckle. Properly handled arc welding is the correct answer to any repairs necessary. Mr. Stokes also spoke about types of painting and kinds of paint to be used and the need for inspection on a yearly basis, after tank repairs have been made.

Fluoridation

A panel discussion was held on the uses of "Fluorine in Drinking Water." The subject was introduced by Harold B. Scales, chemist of the Portland Water District. Mr. Scales reviewed briefly the effects on teeth and mentioned the movement in Maine to have a law passed in the State Legislature to compel the addition of fluorine compound to water supplies. The Maine Water Utilities District had voted against such legal action at its December meeting.

Mr. Scales raised the question as to whether fluoride, added to water, would have the same effect as natural occurring fluorides. He also stated that it was not known whether or not the optimum concentration was the same for natural fluorides as for artificially added fluorides. The question of its effect on other treatments was also not know and the toxicity of the material is still a question.

Mr. Scales pointed out that present studies are experimental and are controlled studies. He believes that it is folly to rush into its use and he doesn't believe that the people know the facts of the matter. He suggests that any addition of fluoride to water supplies should await the approval by the U. S. Public Health Service, and the American Public Health Association and the American Water Works Association. If the addition of fluoride is for experimental purposes, then Mr. Scales

believes it is o.k., but otherwise it should not be done. He agrees with Dr. Wolman's statement that "water works men should not serve as doctors."

The second speaker on this symposium was Paul Butler, chemist of Bangor, Me. Mr. Butler referred to a number of authorities that had written about fluoride and dental caries. He referred to Dr. Bibbey of Tufts College, who had stated that New England has the worst teeth in the United States. Mr. Butler also quoted Dr. Wolman's famous four points, which have appeared in the *Journal of the American Water Works Association*, and he quoted M. Starr Nichols of the University of Wisconsin, discussing the addition of fluorides to water, and the work of Dr. Trendley Deane of the U. S. Public Health Service who desired experiments on geographical distributions, temperature, concentrations, etc.

From the audience Mr. Thomas M. Camp, Cons. Engr., of Boston, rose to speak about fluorides. He referred to the discovery of fluorides in water in the southwest part of the United States and its effect on causing mottled teeth, mentioning that at that time, some fifteen years ago, a maximum of 0.9 ppm. was set above which defluorination should be practiced. Now, he states that it is proposed to add 1.5 ppm. of fluoride. He raised the question as to individual differences and the effects of fluoride on individuals and stated that he believes that the addition of fluoride to water should be opposed. He mentioned the consideration by many cities of its use in practical applications.

Mr. Camp believes these are economically unfeasible. More importantly, he is of the opinion that there has been very little scientific research on the subject until recently and the true effects of fluoride are not yet known. He also believes that action toward adding fluoride to water should be delayed until further information is available.

The next speaker from the floor was Mr. F. J. Reny, General Manager, Portland Water District, who called attention of the group to a newspaper story saying that one of the State legislators was asking for a law to force the City of Portland to build a filter plant and finance it by the sale of reservoir land, because "Portland is poisoning water by the adding of poisoned gas to water." (Chlorine). In view of the fact that fluorine is a much more reactive chemical than chlorine, Mr. Reny is certain that no compound of fluorine should be added to water until the public at large is convinced that it is proper.

Programmers In Action

J. H. White, Chem. Engr., Calgon Co., Boston — *P. Butler, Chemist, Bangor, Me.* — *H. Scales, Chemist, Portland, Me.* — *W. Stokes, Dixie Tank & Bridge Co., Nashville, Tenn.*

The last speaker from the audience was Dr. George E. Symons, Associate Editor, *Water & Sewage Works*, who briefly reviewed before the meeting the history of an attitude held by various investigators and water plant operators throughout the country. Dr. Symons spoke of the work of the Dental Division of the U. S. Public Health Service and their topical application experiments; he mentioned the 10-year experiment at Newburgh and Kingston, N. Y., the work being done in Michigan, and in Wisconsin. He explained more or less in detail how the fluoridation of the water supply at Madison, Wisconsin, was agreed to by the doctors and dentists of the city before any attempt was made to add fluoride to the water. Attention of the audience was called to the fact that in no case was fluorine added to the water, but in every case it was a fluoride. Therefore, this treatment should be known as *fluoridation* not fluorination, and the public should have no fear that fluorine gas or, as Mr. Reny called it, "Devil's breath" was being added to the water supply. Dr. Symons also spoke of the cost of adding fluorides to water, as compared with the treatment of teeth, by the topical application, and the theory as to how it acts as an inhibitor of enzymatic action which produces acids from carbohydrates in the mouth.

While the Maine Water Utilities Assn. opposes any addition of fluorides to water supplies until experiments are complete, Dr. Symons called attention to the contrasting idea as expressed in a number of Wisconsin cities which are now planning to add fluoride to water, the theory being that, during the course of the 10-year period of experimentation at Newburgh and Kingston, N. Y., a whole generation of children will grow up without the benefits of fluoridation, if these benefits are demonstrated. Meanwhile, there is no reason to believe that the addition of fluoride to water causes any ill effects on any of the population; therefore, the attitude is that fluoride should be added as a safeguard until such time as it is proved either useful or non-useful. The cost of treatment is approximately 10c per person per year. Most cities which are now using, or plan to use, the fluoride for water treatment are following the points suggested by Dr. Wolman, and have full approval of both the Health Department and the Water Department before such addition is made.

Mutual Aid

In closing the meeting, the chairman, S. S. Anthony, spoke about the Mutual Aid Committee's questionnaire, asking for material and supplies not on hand. He also referred to the water works meeting in Washington, with the National Security Resources Board, where allocations of materials were discussed, and he said that at that meeting it was agreed that slow-moving stocks such as transmission mains and valves would not be included in any inventory in case of an emergency.

School Children Write on Stream Pollution

Under the sponsorship of the Izaak Walton League, an essay contest was held for grade and high school children in the State of Illinois this past winter. Prizes totaling $300 were offered for the best 200-word essay on "Why Illinois Streams Should Be Rid of Industrial and Human Wastes." The contest received the whole-hearted praise of the Illinois Congress of Parents and Teachers. Five judges including educators and conservationists screened and judged the essays. This sort of contest not only focuses the attention of future citizens on the problem of stream pollution, but it undoubtedly brings the same problem to the attention of parents.

THE CHEMISTRY OF WATER TREATMENT

Part IV—Determination of pH Values

by
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and
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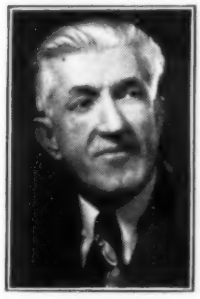


The Author

THE development between the years 1882-87 by the great chemist Arrhenius of the theory of ionization was a revolutionary step forward in the history of chemistry. It provided for the first time concepts which made it possible to understand relationships which had previously been obscure. By means of the theory it was possible for the first time to understand the true nature of the acidity of solutions and the differences between strong and weak acids.

Progress, however, was comparatively slow and up to the year 1910 a total of only about 350 papers had been published in the field. The first two decades of the twentieth century witnessed the publication by Sorensen in 1909 of his basic concept of pH, followed in 1917 by the classic paper of Clark and Lubs on "The Colorimetric Determination of Hydrogen Ion and Its Applications to Bacteriology." In 1920 Clark published the first edition of his monumental work "The Determination of Hydrogen Ions," and this new field of chemistry had come of age.

In the decade 1920-30 colorimetric methods were refined and the hydrogen and quinhydrone electrodes applied to a great variety of problems. The glass electrode which was to become the most reliable and the most useful of all the tools of the chemist for this important determination, was developed in crude form in 1906-09. In 1924 two papers were published describing its application to the determination of pH value and by 1928 thermionic amplifiers had replaced highly sensitive galvanometers and electrometers and the first modern vacuum tube sets appeared. The present day vacuum tube potentiometer represents the greatest advance ever made in the determination of pH values. It is simple and, with proper care, almost foolproof in operation, and it is applicable under a wide variety of conditions. The relatively high cost of these pH meters, however, means that they are not yet available in many of our water and sewage works laboratories throughout the country and colorimetric methods for the determination of pH values, because of the low first cost involved, are still very widely used.

The simplicity of the determination of pH by the use of indicators is such that the operator unfamiliar with the theory involved may unknowingly make serious errors in his determination. It is the purpose of this paper to point out some of these errors and to indicate how they may be avoided.

What Is Meant by Hydrogen Ion Concentration or pH?

The hydrogen ion concentration or pH value of a solution may be defined as its "momentary" acidity or "intensity" of acidity as contrasted with its total or "titratable" acidity. For example, equal volumes of 0.1 M hydrochloric acid and acetic acid have the same total or titratable acidity as measured by the amount of alkali used for neutralization, but their momentary acidities or pH values are very different. Reference has already been made to the introduction by Sorensen in 1909 of the very convenient term pH to express this important quantity. He defined pH as a negative logarithm of the hydrogen ion concentration, or

Eq. 1

$$pH = \log \frac{1}{[H^+]} = -\log [H^+]$$

Every operator is familiar with the fact that on this pH scale, neutrality is expressed as pH 7.00 and acidity increases with decreasing pH values and decreases with increasing pH values.

What Are Indicators?

Almost from the beginning the color change of indicators has proved a useful and fairly accurate method of determining pH values. Indicators may be defined as those substances, usually weak organic acids or bases, which undergo a color change within certain pH ranges. It was originally believed that this color change was due to the ionization of the indicator into ions which possessed a different color from the parent molecule. For example

Eq. 2

$$\underset{\text{Molecule}}{HI} = \underset{}{H^+} + \underset{\text{ion}}{I^-}$$

It is now known that in addition to ionization, a change in molecular structure takes place, but it is still customary to express one colored form in the indicator as (HI_s) and the other form as the indicator ion (I^-). Every operator is familiar with the fact that a color change of an indicator is not sharp but takes place gradually over a considerable range of pH value. One cannot fail to notice also that the useful pH range of color change or "virage" is essentially the same for all indicators, namely 1.6 pH units. The reason for this uniformity is not due to any property of the indicators themselves but to the sensitivity of the average human eye. The ionization constant of an indicator as an acid is calculated as follows:

Eq. 3

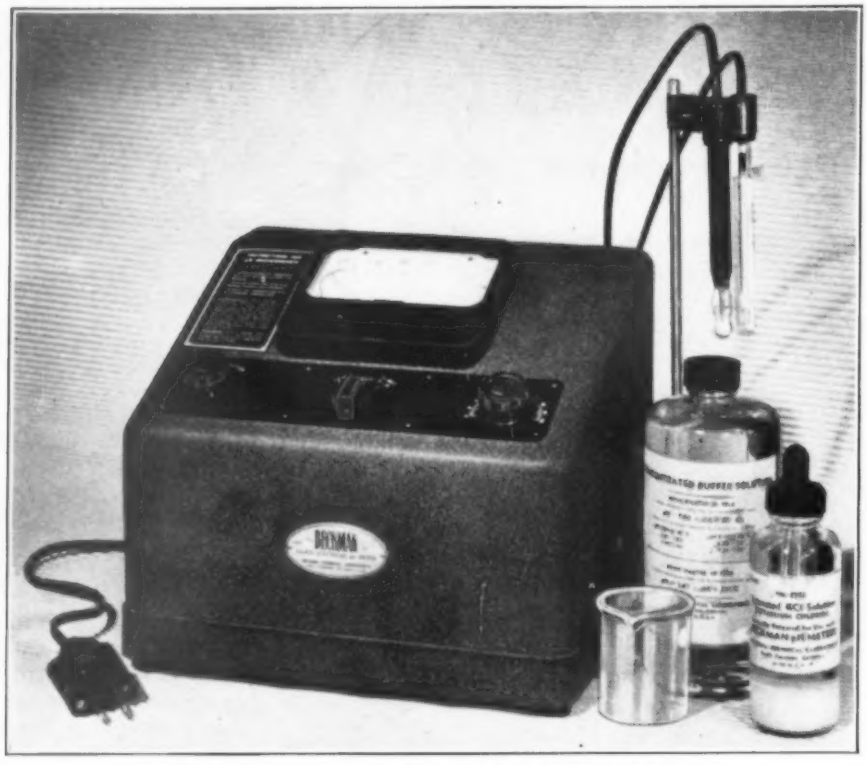
$$\frac{[H]^+ [I^-]}{[HI]} = Ki$$

which can be rearranged to yield the following expression:

Eq. 4

$$pH = pK_i + \log \frac{[I^-]}{[HI]}$$

From this expression it is noted that the pH is proportional to the logarithm of the ratio of the two colored forms. If the human eye were able to discern ten percent of one color in the presence of ninety percent of another color, solving this expression indicates that indicators would have a useful pH range of 2 pH units and the range would be given by the expression:



A Modern Compact and Rugged Portable pH Meter

Eq. 5

$$\text{pH range} = pK_i \pm 1 \text{ pH unit}$$

Thus an indicator with the pK_i of 4 would have a useful pH range of pH 3.0 to pH 5.0. Experience indicates, however, that the average human eye is able to discern only about fourteen percent of one colored form in the presence of eighty-six percent of another, and solving the expression for these values gives a useful pH range of 1.6 pH units as stated above.

The usual technic involving either a block or a slide comparator or some modification thereof, consists in adding five percent by volume of the indicator to the water sample, mixing and comparing the tube with a set of buffer color standards. Two types of errors may be made.

The first type of error is that due to the effect of the indicator itself on the solution to be tested. As an extreme case, let us assume that we are to determine the pH value of pure carbon dioxide-free distilled water using bromthymol blue indicator whose useful pH range is 6.0—7.6. If an indicator solution whose pH is 6.2 is used, one reads a value of pH 6.25 for the sample of water. If the indicator solution has a pH of 7.60 one reads a pH value of 7.55 for the sample of water. In other words, instead of determining the pH of the sample of water, all we determined was the pH of the indicator solution. That the same type of error may be made in determining the pH of certain waters is shown by the second example where the water tested has an alkalinity of 62 ppm. and contains no free CO_2.

Tested with a wide range indicator whose pH is 4.3 a value for the water of pH 7.3 is obtained. If the indicator pH is 7.2 the pH of the water is found to be 7.8. If the pH of the indicator is 10.3 the pH of the water is found to be 8.4. This is admittedly an extreme case since the wide range indicator has been used over a very wide range of pH values. However, with the usual indicators and waters of very low alkalinities such as are encountered in a large number of water treatment plants, errors almost as large may be encountered. It will be interesting to examine the reason for these errors and how to avoid them.

Buffer Capacity. What is it?

The buffer capacity of a solution may be defined as a measure of its resistance to a change of pH value when acid or alkali is added to it. Well buffered solutions are usually composed of a mixture of free acid and its salt or free base and its salt as is known by every chemist who has determined the alkalinity of water using 0.02N sulfuric acid. During the greater part of the titration where a mixture of acid and salt are present in the titration vessel, no indicator change takes place and the solution is buffered. It is only at the end of the titration when all free acid has been neutralized that the indicator changes color. The buffer capacity of a given solution depends not only upon the total concentration of acid and salt present, but also upon the ratio of acid to salt. The hydrogen ion concentration of an acid-salt mixture is given by the expression:

Eq. 6

$$(H)^+ = Ka \frac{(\text{Acid})}{(\text{Salt})}$$

Eq. 7

$$pH = pK + \text{Log} \frac{(\text{Acid})}{(\text{Salt})}$$

It exerts maximum buffer capacity or resistance to change of pH value when the concentrations of acid and salt are equal. The buffer capacity of natural and treated waters is exerted almost entirely by the forms of alkalinity present. In raw waters, for example, the buffer system will consist of free carbon dioxide and bicarbonate ion. In treated waters, the system may be bicarbonate ion and carbonate ion. The hydroxide ion may also be present. Evidently, therefore, waters of high alkalinity would be expected to possess proportionately high buffer capacity whereas waters of very low alkalinity will have little buffer capacity.

For example, when the same wide range indicator used above was employed to determine the pH of a raw water having an alkalinity of 284 ppm. and containing 38 ppm. of free carbon dioxide, determinations with three bottles of wide range indicator having pH values of 4.3, 7.2 and 10.3, yielded a uniform value of 6.90 for the pH of the water. The operator determining the pH value of a soft surface water following coagulation and whose alkalinity may not be more than 5-10 ppm. may easily make an error of several tenths of a pH unit in determining its pH value unless very careful precautions are observed.

Equation 7 above also explains a very interesting property of buffered solutions, namely, that they may be rather largely diluted without appreciable change in pH value. In this respect they differ markedly from unbuffered solutions. For example, if one adds to one volume of .1 N hydrochloric acid, pH = 1.0, nine volumes of distilled water the resulting solution will be .01 N and its pH will be 2.0. A second tenfold dilution will yield a solution with a pH of 3.0.

On the other hand, if one dillutes a well buffered natural water with an equal volume of distilled water, the pH of the mixture will differ only slightly from that of the undiluted water. If a sample of such water is diluted ten times with distilled water, its pH will be found to have been increased by less than 0.2 pH unit. Equation 7 shows that the pH of a

buffered solution is a function of the *ratio* of acid to salt and obviously such a ratio would not be changed by dilution. The slight change which does take place will be explained later.

Isohydric Indicators

Ideally, the pH of the indicator used for a determination should be the same as the pH of the water to be tested. Such indicators are called "Isohydric." Such indicators, however, are difficult to prepare and even more difficult to keep since they readily change their pH value upon standing. In the ideal case and using thymol blue pH 8.0-9.6 as an example, one would have available five different bottles of indicator solution adjusted to pH values 8.2, 8.5, 8.8, 9.1, 9.4. The first determination would be made with the mid-point indicator and a second determination then made using the bottle of indicator which corresponds most nearly to the value obtained in the first test. By the use of such technic, very accurate results can be obtained by the colorimetric method on unbuffered solutions.

A second but more tedious method consists in determining the pH of the sample using a small volume of indicator and repeating the determination with a larger volume of indicator. If no change in pH is observed the result may be considered to be correct. If a change upward or downward is observed when the second determination is made, the pH of the indicator solution itself is adjusted by the careful addition of small quantities of 0.01 N acid or alkali until the same pH value is obtained for the water using two different volumes of the indicator. One is thus assured that the indicator has been adjusted to a pH very close to that of the water.

A compromise most commonly used is to employ indicators adjusted to the mid-point of their useful pH range. While indicator solutions are adjusted to this point before being shipped they change rapidly upon standing. They should be frequently adjusted by the careful addition of acid or alkali to the mid-point. In the case of the thymol blue mentioned above, this may be done after shaking to observe the color of the foam produced. If the indicator is too acid, the foam will be bright yellow with a tinge of pink. If it is too alkaline, the foam will be a deep bluish purple. At its mid-point, the foam produced by shaking is a gray-green which is easily recognized.

Probably the most difficult type of water for accurate pH determination by the colorimetric method is the effluent from a coagulation plant before stabilization. Such a water will usually have very low alkalinity and may contain relatively high concentrations of free carbon dioxide. The preferred technic for such determination is as follows: The indicator to be used is added to the empty colorimeter tube, the sample drawn from the container into a 10 ml. pipette, the tip of the pipette placed in the indicator solution and the water allowed to flow into the tube. If the pipette is slowly raised, as the water passes into the tube a uniform mixture of water and indicator may be secured without further mixing.

The pH is then read quickly before loss of carbon dioxide takes place. Such waters should never be filtered before the pH is determined, since filtration will provide sufficient aeration for substantial loss of carbon dioxide and consequent change in pH value. Reference to Equation 7 will illustrate why this is so. In that equation "salt" is represented by alkalinity and if the alkalinity of the coagulated water is very low we have a fraction with a very small denominator and obviously a small change in "acid" which in this case is free carbon dioxide, will produce a relatively large change in pH value.

Errors Due to Salt Effect

In recent years our knowledge of the behavior of ions in dilute aqueous solutions has been greatly expanded and new concepts have been advanced which have served to change in some respects our older ideas. The theory of ionization as originally advanced by Arrhenius did not take into consideration the effects exerted by the different ions present in solutions. All of us are familiar with the fact that if a sample of gas at ordinary temperature and pressure is compressed its volume will decrease inversely with the pressure until a point is reached where the volume of the particles themselves and their mutual attraction causes the law to fail. The ions in a dilute solution may be compared to the particles of gas except that the ions are electrically charged and their effects upon each other cannot be ignored even in dilute solutions.

For example, let us suppose that we determine colorimetrically the pH value of a sample of potable water and a sample of sea water and find identical values of pH 8.20. The hydrogen ion *activities* of the two solutions are not, however, the same. The sample of potable water had an "ionic strength" much less than the buffer color standard with which it was compared and the value which we read was too low by about 0.18 pH unit.

On the other hand, the ionic strength of the sea water was more than ten times greater than that of the buffer color standard and the value which we read was too high and must be corrected by approximately the same amount. This is due to the fact that the color of an indicator is determined by the ratio of the *concentrations* of its two colored forms and not of their activities. When one determines what we usually term the pH of a sample electrometrically, what we actually determine is the hydrogen ion *activity* expressed as paH.

The difference between the pH value of a solution determined colorimetrically and its paH value determined electrometrically, is called the "salt effect" of the indicator. If the ionic strength of a given solution is the same as the ionic strength of the buffer color standard with which it is compared, then identical values will be obtained using colorimetric and electrometric methods. In the case of natural and treated water, however, their concentrations expressed in moles per liter will vary from perhaps 0.001 M to 0.01 M and their ionic strengths, while differing from the above values, are proportionately small whereas the ionic strength of the buffer color standards now available vary from 0.05 M to 0.1 M which means that the water or sewage works operator may expect to obtain for a given sample a colorimetric pH value approximately 0.2 pH unit lower than the value obtained by a pH meter.

Inasmuch as the same term pH is used throughout most of the literature to express both values, the situation is definitely confusing. It would be greatly simplified if values determined with the pH meter were expressed as paH and values obtained colorimetrically were expressed as pH. Any value could then be expressed in terms of the other by adding or subtracting the appropriate salt correction. This difference may not be important in some cases but it may be quite important in others. In Part III of this series ("Stabilization"), the importance of the pH of the finished water was emphasized and its influence upon the corrosive or encrusting properties of a given water was discussed. In that paper the term pH was used throughout whereas most of the newer theories of stabilization which were discussed have been based upon calculation of the activities of the ions present in the treated water and the equations presented yield values for hydrogen ion activities and not hydrogen ion concentrations. Specifically, the "saturation pH," or pH's of Langelier, is in reality a paHs and the operator employing colorimetric methods for his determinations should correct his values accordingly.

"WATER WITCHING"

Is it a Science, an Art, or the Bunk—If Neither, What?

by
PAUL C. ZIEMKE
OAK RIDGE, TENN.

"WATER WITCHING"—what words to conjure with! Since there is a large bump of curiosity in the best of us—whether scientifically trained, a tiller of the soil, or a shop welder, intrigue and superstition have us all as followers to some degree. Certain it is that for a large cross section of country-reared folk, no amount of scientific proof or argument will dissuade them one iota from their belief that there is more than luck in the art of dowsing, divining, or witching for water by those who have the "power."

From the personal angle, the author can lay claim to having located two very important wells in his day. One was on an arid prairie in drought time when water was *really* at a premium, and the other on a Midwest farm where numerous test wells turned out to be "dusters." However, as a debit to the other side, there is the record of much hopeless probing over a wide area to furnish water for a large lumber camp that had to haul water nearly eighteen miles from the city hydrants during the torrid days of summer when the creek water failed to meet health standards, even for the horses. On that occasion the fallibility of the witching technique was tested. Eventually, in desperation, the hunt failed in every direction except in that of a known spring that had been previously ruled out as being too distant for economic consideration. This spring, flowing out of a gravel bank, had an apparent volume of 200 gallons per minute as measured by a crude weir. Witching with not one but a variety of the recommended woods, and in the hands of several alleged witchers operating in the vicinity of this spring, none of us could record an indication that a water vein was nearby, although the water obviously flowed merrily right under the sod to emerge a few yards beyond. Eventually, this spring water was gasoline pump-lifted to a small stave stand pipe on the camp site hill.

This failure to locate water by water witching provoked a great deal of conversation in the camp of an evening, and some rivalry developed on both sides of the question. The water witcher is a sort of magician who hies himself off to the nearest clump of hazel brush or willow, all depending on the individual's likes in the matter, to cut a staff. The preference seems to be to select a wood which will provide a shaft about the size of a jackknife handle just below the fork of two branches. The two branches opposite each other are usually cut to about eighteen inches in length. He grasps two branches near the tips, one in each hand, and holds the butt horizontally out ahead of him. By this means he claims to follow the inclination of the water-seeking butt to lean to right or left or to indicate a pronounced tendency to "dip" earthward if sub-surface water is close at hand. Some witchers claim that absolute silence must be maintained during the search (seance), although how extraneous noises affect the issue one way or another is problematical.

The origin of the "divining-rod" is lost in obscure antiquity, although many ancient writings do make reference to its use. The Bible mentions the "rod" in several instances, particularly in the book of Moses. There we read: "And Moses lifted his hand, and with his rod he smote the rock twice; and the water came out abundantly . . ." This Biblical account has caused many witchers to lay claim to even broader powers, such as the finding of precious ores or buried treasure. Early Spanish writers mention the use of rods to find water, and it is believed that the idea spread from that time.

Obvious, it is, that the widespread use of the art could not have been so recognized had not the list of the successful explorations for water well exceeded the failures. It is a known fact that locating successful wells by this method far outnumber the failures of the diviners, even though it is only fair to admit that some of the producers would have been located anyway without the aid of the "diviner."

Some Opinions

An unofficial check among geologists and engineers of repute has brought to light three significant conclusions on the subject of water witching. Said C. S. Gwynn of Iowa State College: "I place no stock in the claims made for water witching, yet I rarely dissuade others from the belief." This thought seemed to prevail with the majority of the persons questioned. Practically all the geologists interrogated said: "Don't quote me in saying that the idea is a lot of hokum." None of the group expressed any faith in the powers of the witcher. Why these men refuse to credit the witchers with supernatural powers in definite terms is probably explained by the statement that none of them have been effectively able to prove that forked sticks cannot find water. Being of a scientific mind, they know that damning a thing as a hoax and fraud is one thing, but proving as much is often nearly impossible.

Another group of persons intimately tied to the finding of potable water are the well drillers who, though not quite in line with the geologists and engineers in their statements, have members definitely on both sides of the question. Their opinions range from perfect faith to violent disbelief. A cross section of opinion has it that the probability of striking water on a "witched spot" has a 50-50 chance of making good.

The technical press has taken recognition of the issue, both pro and con in voluminous literature that ranges from official government reports and engineering studies to papers by recognized authorities. The U.S.G.S. Water Supply Paper No. 416, "History of Water Witching," compiled by Arthur J. Ellis, contains a complete bibliographical section of nearly 600 publications on the subject of water witching. On page five of the introduction, O. E. Meinzer sums up the situation very well indeed when he states in part: "It is difficult to see how for *practical* purposes the entire matter (water witching) could be thoroughly discredited, but it should be obvious to everyone that further tests by the United States Geological Survey of this so-called 'water witching' . . . would be a misuse of public funds." Still further on page six Meinzer states: "To all inquirers the United States Geological Survey gives advice not to expend any money for the services of a water witch."

That the idea is not beyond the realm of possibility is also conceded by the author. It is, however, not a very tenable argument when five blind-folded individuals using the "wand" walk over a four-foot diameter water main, carrying the entire city water supply, and don't register the pull that certainly should have been manifested to at least one of the group, whether "believers" or not.

31st TEXAS WATER and SEWAGE WORKS SHORT SCHOOL*

Boasts Record Registration of Four Hundred and Thirty-Three

"BIGGER and better", an expression widely used by Texans, accurately describes the Thirty-First Texas Water and Sewage Works Short School held at Texas A. & M. College, College Station, Texas, February 6-10, 1949. The Short School is sponsored by the Texas Water and Sewage Works Association in cooperation with the State Dept. of Health, Southwest Section of A.W.W.A., the State Board for Vocational Education, and Texas A. & M. College. The registration surpassed that of any previous short school, with a total of 433 registered, and an additional number of guests.

Special out-of-state speakers who participated in the program were Linn H. Enslow, Editor of *"Water and Sewage Works"* and President of the American Water Works Association, New York; W. H. Wisely, Executive Secretary of the Federation of Sewage Works Associations, Champaign, Ill.; F. E. DeMartini, who substituted for Carl E. Schwob, Chief of Division of Water Pollution Control, U. S. Public Health Service, Washington, D. C.; W. A. Hardenbergh, Editor of *"Public Works"*, New York and A. E. Griffin of Wallace & Tiernan Co., Newark, N. J.

Highly beneficial demonstrations of taste and odor control techniques were conducted daily by Messrs. Henry F. Laughlin and David C. Colebaugh of the Industrial Chemical Sales Div. of the West Virginia Pulp and Paper Co., Tyrone, Pa.

At the joint meeting of the Regional Water and Sewage Works Associations, Mr. Linn H. Enslow addressed the group on "Water Supply—Some Pertinent Observations Concerning Current Practices and Policies," in which he presented some very interesting and illuminating observations on "what's new" in the water works industry. At this same session Mr. W. H. Wisely spoke to the group on "How We Can Improve the Standing of the Sewage Works Operator," in which he offered suggestions and ideas for the men engaged in the sewage works profession to raise their status in the community. Both speakers were enthusiastically received by the group.

At the regular annual business meeting Secretary V. M. Ehlers reported that during the year 18 regional associations (652 members) had ratified the constitution and by-laws of the Texas Water and Sewage Works Association, thereby becoming member associations in the state organization.

Old and New Officers

Officers who have so ably served the Texas Water and Sewage Works Assn. during the past year were N. E. Trostle, Temple, President; Vice Presidents, E. J. Umbenhauer, El Paso; Homer A. Hunter, Dallas; J. L. Swanson, Port Arthur; and Uel Stephens, Fort Worth; Secretary, V. M. Ehlers, Austin; Assistant Secretary-Treasurer, Mrs. Earl H. Goodwin, Austin. The following new officers were elected for 1949: President, E. J. Umbenhauer, El Paso; Vice Presidents, K. F. Hoefle, Dallas; J. H. Sorrels, College Station; A. H. Ullrich, Austin; and E. J. M. Berg, San Antonio. V. M. Ehlers was continued as Secretary and Mrs. Earl H. Goodwin as Asst. Secy. and Treas.

New President
E. J. Umbenhauer
Supt. W. & S. Wks.
El Paso, Tex.

Perpetual Secy.
V. M. Ehlers
State San. Engr.
Austin, Tex.

Resolutions Adopted

Some of the more important resolutions adopted by the Association included (1) requesting Congress to assist in remedying the material shortages for essential water and sewer improvements; (2) since present machinery is not adequate to provide water in certain areas in Texas that the Legislature be petitioned to study the situation, two possible solutions being suggested; (3) that President Harry S. Truman be requested to appoint a member from the Southwest to the Advisory Committee on Water Pollution Control; (4) that the Texas Legislature be requested to consider appropriating at least $50,000 for stream pollution studies and research; and (5) that the appropriation for the certification of water and sewage plant operators be increased from $11,000 to $15,000 for the purpose of raising the salaries of field supervisors and paying the expenses of the Examining Board.

A.W.W.A. Luncheon and Banquet

A special luncheon was sponsored by members of the Southwest Section of the American Water Works Association, now the second largest section of A.W.W.A. Mr. Henry Wilkens, Jr., Texas Trustee of the Southwest Section, presided at this session and introduced Mr. Linn H. Enslow, President of the parent Association, who reviewed activities of the Association and addressed the group on "What A.W.W.A. Can Mean to You." There was an excellent attendance at this luncheon session.

On Wednesday evening the regular annual banquet session was held with President N. E. Trostle presiding. The guest speaker for this session was Col. W. A. Hardenbergh, Editor of *Public Works*, who spoke on "Civil Defense" and gave a very interesting review of a voluminous report recently released by the National Security Council in Washington entitled "Civilian Defense for National Security."

One of the highlights of every banquet session is the review by Dr. George W. Cox, State Health Officer of Texas, of "Accomplishments in the Water and Sewage Fields in Texas During the Year." At this time Dr. Cox announces the State Department of Health "Honor Roll," revealing achievements of various communities in the nature of improvements to Texas water and sewage systems.

To Water Works Systems

San Angelo—for highest percentage of population connected to water supply system.

Port Arthur—for maintaining the best bacteriological record for 1948.

Houston Water Dept. Laboratory—best water plant laboratory for control.

To Sewerage Systems

Mineral Wells—for having the highest percentage of its population connected to sewerage system.

Boerne, Crane, Llano and Jourdanton—for having the greatest ratio of

*Excerpts from a report by Mrs. E. H. Goodwin, Ass't. to Secy. V. M. Ehlers, Texas Water and Sewage Works Assn.

sewer connections completed during the year.

Fredericksburg—making best use of its sewage plant effluent in irrigation.

Corpus Christi—making industrial use of its sewage effluent.

Austin—most effective disposal of sewage sludge by selling it as fertilizer.

Dallas—for maintaining the best sewage plant laboratory for control.

The following special awards in the form of loving cups and plaques were made by Dr. Cox:

Graham—for the water plant presenting the most attractive appearance.

Mount Pleasant—for completing the greatest improvement to its water system.

Childress—for maintaining the most attractive sewage treatment plant.

Red River Arsenal—for having the sewage treatment plant consistently producing the highest grade sewage effluent.

Alice—for completing the greatest improvements to its sewage treatment plant during 1948.

Mr. Earle W. Sudderth of Dallas, Chairman of the Committee on Awards, then presented the report of the committee and made appropriate awards as follows:

Honorary Life Memberships to G. L. Fugate of Houston and Walter F. Hicks of Paris, in recognition of outstanding service to the organization for many years.

A $100 Government Bond was presented to Mr. Clayton H. Billings of Austin for his faithful and valuable service to the Association.

The Attendance Award to the regional association having the highest score of attendance at the Short School was won by the Lower Rio Grande Valley Association.

Two new awards were presented by Mr. Linn H. Enslow as follows:

The Central Rio Grande Association received the award from the Southwest Section A.W.W.A. for having the highest percentage of approved public water supplies within its boundaries in 1948.

The Northwest Texas Water Works Association was the recipient of the award made available by the *Southwest Water Works Journal* for the district association with the highest percentage of licensed operators.

At the close of the short school 72 water and sewage plant operators took examinations for certification as Grade A, B or C operators.

N.J. SECTION'S MID-WINTER MEETING HUGE SUCCESS

EXPECTING 90 to 100 registrants for the Annual Mid-Winter lunch and meeting of the N.J. Section in Newark on Feb. 17, the officers and program committee were overwhelmed with a turnout of 170. This was another demonstration of what a good program will do toward attracting record attendance at section meetings, even for a one day meeting.

Practical Hydraulics

Without doubt a strong drawing card for this meeting was the demonstration of practical hydraulics by representatives from the Pennsylvania State College. This presentation, together with four other equally interesting papers, made up the technical session following a lunch. Robt. E. Stiemke, Prof. of San. Engr., and R. R. Kountz, Asst. Prof. San. Engr., together with Tom Iezzi, Jr., San. Engr. and C. F. Abel, Grad. Student, State College, Penna., brought all of the equipment which they had used to make this demonstration of the science of hydraulics when it was first presented at the meeting of the Penna. Water Works Operators Assn. at State College, Penna., last August.

By actual demonstration of the weight of water passing through pipes under a constant head in a given time, this team showed the loss of head through pipes, the effect of roughness in pipes, the effect of valves and fittings, loss of head in orifices, why orifices measure flows, and many other manifestations of hydraulics in a piping system. The demonstration lasted for an hour.

Laying Pipe

A. F. Pleibel, Sales Engr., R. D. Wood Co., Philadelphia, Penna., presented a motion picture showing proper handling and installation practices for the laying of cast iron pipe. The picture began with the unloading of the pipe from the car, its distribution along the trench line, its handling, cleaning, jointing by lead or sulfur joint compounds, sterilizing, and testing.

Main Line Meters

D. J. Purdie, Builders Iron Foundry Co., New York City, spoke about "MAIN LINE METERS," their location, maintenance and care. In the placement of meters whether vertical, horizontal, or inclined, it is important that the meter be kept at least a minimum distance away from fittings, and where no air can enter the meter.

Certain precautions must be exercised in reference to the secondary measuring or recording device which is operated from the meter. Pipe leading to the secondary device should be of non-corrosive material and provision should be made so that no air enters these transmission pipes.

In choosing the size of the meter, it is important that the meter should not be oversized. In the care of meters, the operators should have at hand the manufacturers' books on maintenance and operation of the meter. A meter should read correctly, and it is well to check the zero setting at regular intervals and to keep the machine lubricated as required.

Hydrants

The "PROPER INSTALLATION AND MAINTENANCE OF HYDRANTS" was the subject of the short paper presented by H. A. Gaffin, A. P. Smith Co., East Orange, N.J. Mr. Gaffin spoke of causes of non-delivery of water from hydrants and the reasons therefore, including frost, human mistakes, and mechanical defects.

By means of diagrams, the speaker showed the proper installation of various types of hydrants and commented on provision of proper drainage of hydrants after use. Hydrants should be checked at least twice a year for lubrication and operation, and should be removed for complete servicing at least every five years.

Pipe Cleaning

"PROBLEMS IN WATER MAIN CLEANING" were discussed by Robt. Hardman, Ch. Engr., National Water Main Cleaning Co., New York City. Mr. Hardman spoke about why pipes need cleaning and the results obtained by cleaning, in producing more water at lower pumping costs. Cleaning will restore about 95 per cent of the original capacity of the pipe. For pipe that has been in service for 30 years, cleaning will increase the delivery of water by 40 to 60 per cent.

Mr. Hardman described the operation of a cleaning machine, how it is cut into a pipe, how it is drawn through a pipe by cable or forced through by water pressure (depending on the size of the pipe) and what problems may be met in the operation, such as partially closed valves, etc.

PROBLEMS AND METHODS OF RATE ADJUSTMENTS*

by

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Mgr. & Engr.
COMMISSIONERS OF PUBLIC WORKS
NEWBERRY, SOUTH CAROLINA

IN ORDER to fully appreciate any method or methods used in adjusting water rates, it is necessary that we delve into the past a little in order to become acquainted with rate problems. This article does not attempt to go into the technicalities of rates, but merely attempts to show the underlying cause of the need for rate investigation and some method of obtaining consumer support where adjustments are necessary. The problem of a fair and just charge for water is one of the oldest and still unsolved problems in the water works field.

When most municipalities started a water works, prior to the development of water meters, the charges were based on so much per spigot, house, or connection. Today, we look back on such a rate structure as being ridiculous and yet one may wonder what the opinions of water works officials will be 50 years hence when they in turn look back on present day rate structures.

We have often heard the old adage of "Charge what the traffic will bear." This thought is entirely wrong and should be dismissed from our minds before a start is even made in adjusting rates. It will be impossible to sell your consumer on such a charge unless you yourself are sold on your fair and just rate. Basically any water rate should be sufficient to cover (a) the cost of operations (b) the cost of depreciation (c) the cost of capital improvements. It is well to remember that all these costs should be considered at present day levels. In adjusting rates, definite facts and figures of these costs are beneficial, and all water departments should put more effort in obtaining a better system of cost accounting.

If it is possible to show from cost records how the cost of materials and labor has increased year by year it will help in putting across the need of a rate increase. If our water departments are now without adequate costs records, we should resolve never to be caught again. For as sure as we adjust rates today the time will eventually come when we will be compelled to re-adjust rates to meet the changing times.

The Author

Rate Increases Advocated

In 1944, Charles H. Capen was one of the first advocates of modernizing water rates. In the October 1944 issue of the *Journal of the American Water Works Assn.*, Mr. Capen said "Every water works man knows that even a slight change in established rates is quite apt to bring a storm of protest from the local clubs, public press, sewing circles, John Q. Public, and in fact any one who can read, write, and talk about affairs concerning which most frequently his lack of knowledge is amazing." In adjusting rates it is important to gain the support of all these organizations and get them on your side at the very beginning.

In the June 1946 *Journal of A. W. W. A.*, Louis R. Howson analyzed construction costs with water rates. In the Sept. 1947 issue, Mr. Howson showed the need in adjusting rates to offset increased costs and again in the March 1948 issue, he showed the need for increased water rates. In these series of articles, Mr. Howson definitely shows that an overall increase of approximately 30 per cent in water rates will be needed if the water works industry is to continue its growth and expansion.

The many needs for reviewing and adjusting water rates, wherever necessary, is sufficient to warrant an investigation and study on our part in order to determine if our rates are adequate for present day operations and future expansion. It has been said "that if your water rates were fair and just in 1939 and have not been adjusted since this time, then your rates are too low today." By the same token a rate that is fair and just today does not mean it will be fair and just 10 years hence. Rates should be adjusted as operating costs fluctuate, and the writer is of the opinion that rates should be fully reviewed every 5 to 10 years. No water works official would advocate a rate that charges more for water than can be justified; however, we owe it to the community which we serve to establish a sound rate structure in order that provisions will be made to adequately maintain the existing water works system and establish a sound program for future requirements.

The writer has attempted above to show the reason for analyzing water rates and to make adjustments wherever necessary. One of the greatest problems is how this can be accomplished and still prevent the water works official's head from winding up on the chopping block. It can be and has been accomplished in St. Paul, Minn.; Chester, Pa.; Syracuse, N. Y.; and many other towns and cities with a reported minimum of customer complaint. When a rate adjustment is necessary the water works official must become a salesman and sell the new rate adjustment to the consumer. Any successful salesman would advise that first he himself is sold on his product before he could make a success selling to others. Likewise the water works official must be sold on the new rate structure before he should attempt to sell it to the consumers. All employees of the water department should be fully informed of the new rate structure since they are excellent disciples of your public relations program.

How To Reach the Consumer

In order that the water department may increase or adjust its rates with a minimum of confusion and complaint on the part of the consumers, the following media should be used in order to reach all consumers: (1) Direct contact with the consumers, (2) local newspapers, (3) service and civic clubs, and (4) local radio. A full report of your past operations and plans for the future should be included

*This paper, presented by the author before the Southeastern Section of A.W.W.A., has been released by the Association for publication in *Water & Sewage Works*.

in a special letter-report to the consumers. Show in this report why a rate adjustment is necessary and how increased revenues will enable the water department to maintain a high degree of efficiency in its operations and aid in expanding plant facilities. This method was used at Newberry and gained support for an approximately 55 per cent increase in water rates. At Newberry a mimeographed letter was forwarded to each consumer showing in detail why the revenues were insufficient to provide needed expansion to the utility system. The public support was practically 100 per cent in this rate adjustment. It is well to enclose a copy of the new rates to the consumers and they should know the effective date of the new rates at least 30 days in advance. This report to the consumer should be simple, honest, and sincere and *not* too technical; but worded so that the average consumer can understand it.

Newspapers—If you are not on good terms with your local editors, gain their support before starting a rate adjustment. If the editors of the local papers are sympathetic toward a rate adjustment, they will be in a position to grant the water department all the breaks possible in good newspaper publicity. If your department is not prohibited from advertising it is well to insert a few advertisements in the papers in regards to the need for a rate adjustment.

Civic and Service Clubs—Your local service and civic organizations generally are public spirited. It is well to appear before such clubs and present to them the problems of your water department and show why a rate adjustment is necessary. The members of the clubs are usually business men and easily understand increased costs of living, profits and losses, and need for capital improvements. A few minutes spent at each service club will be well worth your time in addition to a probable free lunch.

Radio—If you have a local radio station and the Program Manager is cooperative, it is possible to work out a forum type radio program which will enable the listeners, who are also your consumers, to obtain answers to any questions which probably exist in their minds also. The writer believes that the water works official will find this an excellent means of reaching the consumer and will prove beneficial in gaining consumer support.

AFTER you have accomplished your planned program toward gaining consumer support of new rates, put the new rates in effect and *do not back down* even from pressure groups who feel they should be given special consideration.

Conclusions

There are a few conclusions which can be derived from an analysis of the rate situation:

(1) Every water works official should take the time now to analyze his rates and determine if they are sufficient for present day operations and future expansions. It is just as important for the financial structure of a Water Department to be on a firm foundation as it is to provide a pure and safe water supply.

(2) If a rate adjustment is needed this is an excellent time to inaugurate a rate adjustment campaign, as the power utilities are now being compelled to ask for rate increases in order to offset increased costs.

(3) The policy of keeping the public well informed on all operations of the water department will prove to pay off good dividends in order to obtain consumer support when the time comes to adjust rates.

NATIONAL COUNCIL FOR STREAM IMPROVEMENT ANNUAL MEETING

At the annual meeting of the National Council for Stream Improvement of the Pulp, Paper, and Paperboard Industries, Inc., on Feb. 23 in New York City, Chairman of the Board George E. Dyke reviewed the progress of the Council's work during the past year. Paying tribute to the staff including Dr. Harry Gehm as Technical Advisor, and Russel Winget as Exec. Secy., Mr. Dyke explained how the research on industrial waste problems was distributed throughout seven regions of the country in order to best serve the particular interests of industries in different localities.

Progress of the Council's research work has been detailed in the annual report covering the work at eleven universities and research organizations. Membership in the Council continues to grow, and now represents more than 85 per cent of the total tonnage of the industry. So successful has been the approach of the council to industrial waste problems in this field that public authorities are now accepting the Council's ideas and help, and other industrial groups are patterning their attack on industrial waste problems after the Council's ideas.

Following the Chairman's annual address, two speakers presented papers to the assembled members of the Council. First to speak was A. H. Wieters, Sr. San. Engr., U.S.P.H.S., Washington, D.C. Mr. Wieters spoke on Public Law 845 and outlined the program which the Pub. Health Service has set up to be carried out under this law. Mr. Wieters emphasized the cooperative approach with state organizations, and the regional or river basin concept of industrial waste abatement, with full consideration being given to the development of standards that are flexible and are based on reasonable use of the water.

The second speaker, Prof. Earle B. Phelps, Dept. of Civ. Engr., Univ. of Fla., spoke on "Stream Conservation," pointing out that this implied recognition of the facts that all waters have uses which are varied and which invite abuse and impairment. In reviewing the subject of rights where water use is concerned, Prof. Phelps quoted the opinion of Mr. Justice Holmes in reference to the diversion of Delaware River water to the City of New York. Holmes' opinion recognized the principle of maximum beneficial use as a modification of the principle of prior rights and opposed to strict riparian rights. This is the engineer's approach and is rational.

In approaching the subject of stream conservation, it must be recognized that there are many uses of streams that are not compatible with others. Sewage or waste disposal is not compatible with most other uses to which a stream may be put, and yet streams must serve to some extent to carry wastes away from both municipalities and industries. But such use should not overtax the capacity of the stream. Even the maximum beneficial use of a stream does not mean "ruinous use."

There are three motives to abate pollution: economics, public relations, and "the big stick" of government. While there is still much need for research, it is now well known that the elimination of nuisance in a stream is the main objective. Nuisance, however, may be based on different criteria for different uses to which the stream is to be put. One thing is certain; the cost of waste treatment is a legitimate cost of production for industry. With the coming of P.L. 845 and the passage of state pollution control laws, industry need have little fear that, in the future, this cost will mean an unfair competitive advantage to industry in one state as opposed to another.

RATE OF PRODUCTION OF OXYGEN BY FREELY DEVELOPING ALGAE

by
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Chemist
SEWAGE DISPOSAL DEPT.
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PRELIMINARY work has been reported on the production of oxygen by the algae which develop spontaneously in settled sewage on exposure to light[1]. The rate tended to accelerate for some days and there was a simultaneous visible increase in the amount of chlorophyll. The work reported below was designed to define the characteristics of the rate of oxygen production.

Oxygen Production in Diffused Daylight

A constant intensity of illumination throughout the day is unnatural. Mixtures have therefore been exposed in full stoppered 300 ml. glass bottles at a window facing almost due north in a thermostatically-controlled small room. Duplicate bottles were placed nearby, wrapped in two layers of brown paper. The bottles were withdrawn in pairs for oxygen determination by the Rideal-Stewart modification of the Winkler test. The difference between the oxygen content in the light and in the dark is taken as the principal index of the changes occurring.

Dilution with tap water was necessary owing to the limited solubility of oxygen in water and the difficulty of determining it in the presence of much organic matter.

The following symbols are used in describing the experiments:

O_o = the initial oxygen content in parts per million.

O_l = the oxygen content of the exposed bottle in t days.

O_d = the oxygen content of the dark bottle after t days.

$Y = O_l - O_d$.

$Z = O_l - O_o$.

Y is assumed to be the gross oxygen produced in t days in the exposed bottle for the comparatively short periods involved. Z is the net oxygen produced in t days.

Mixtures exposed as described above give off oxygen at a linear rate in the middle of the day, i.e., for 5 hours in April. A daily cycle in the dissolved oxygen content (O_l) is noted when the test is continued for longer periods. A similar variation was found by Butcher et al [2] for streams. Owing to the cessation of oxygen production by photosynthesis at night the dissolved oxygen content passes from a maximum in the afternoon to a minimum in the early morning. Under the experimental conditions under discussion the maximum value of O_l tends to increase each day. Samples have been withdrawn at exactly 24-hour intervals to measure this tendency. It is then found that the gross amount of oxygen produced (Y) is related to the time in days (t) by an equation *provided t is an integer*. In example A in Table I the equation was found to be:

Eq. (1)

$$\text{Log}_{10}Y = 0.303 + 1.65 \log_{10}t.$$

It was a highly purified effluent which had developed very small green organisms and was diluted with seven volumes of tap water. In example B in Table I the equation was

Eq. (2)

$$\text{Log}_{10}Y = 0.49 + 1.27 \log_{10}t.$$

This was a settled sewage in which a strong algal culture was developing. It was diluted with 25 volumes of tap water. Both equations are variants of the general equation

Eq. (3)

$$Y = at.^b$$

where Y and t have the values defined above and a and b are constant coefficients in each case.

It has been assumed in the foregoing that the loss of oxygen through respiration of the chlorophyll containing organisms and the reactions which register in the B.O.D. test is the same in duplicate bottles incubated in the dark and in the light. This can only be true for short periods because:

a. Rate of respiratory loss of oxygen can be shown to increase as organic matter is synthesized in the light.

b. The chlorophyll green can be seen to gradually disappear during storage in the dark. It may be supposed that this change is accompanied by a change from respiration to decay which will cause the rate of loss of oxygen to change. The ability to photosynthesize oxygen on exposure to the light is little affected by two days' storage in the dark. Considerable photosynthetic ability survives 14 days' storage in the dark at 65° F., provided dissolved oxygen is present throughout. Photosynthetic activity has survived three days' anaerobic incubation. Errors due to these factors are probably low in the experiments already cited since the rate of production of oxygen greatly exceeds the combined rate of the loss of oxygen. The possibility of such errors can be minimized by somewhat altering the conditions of the test as described in the next paragraph.

Table I.

GROSS RATE OF OXYGEN PRODUCTION BY ALGAE IN FULL STOPPERED BOTTLES. All Results in ppm.

Days t.	Dissolved oxygen content of O_l Illuminated bottle.	Dissolved oxygen content of O_d Dark bottle.	Gross oxygen produced $Y = O_l - O_d$ Exptl.	Gross oxygen produced $Y = O_l - O_d$ Calc. from equation
		Example A		
1	10.48	8.21	2.27	2.01
3	19.61	7.58	12.03	12.30
4	27.40	7.31	20.09	19.78
		Example B		
1	10.97	7.87	3.10	3.10
2	14.30	6.80	7.50	7.45
3	18.80	6.35	12.45	12.50

Parts per million of dissolved oxygen in dilution.
Equation used for A. $\text{Log}_{10}Y = 0.303 + 1.65\ \text{Log}_{10}t$.
Equation used for B. $\text{Log}_{10}Y = 0.49 + 1.27\ \text{Log}_{10}t$

	O_o	Temp. C.	Dilution
A	9.28	12	1 : 7
B	9.41	12	1 : 25

Technic

A mixture is made and a number of glass stoppered bottles filled therefrom. One is covered, the others exposed. After 24 hours, the oxygen content is determined in the bottle kept in the dark and in one of the illuminated bottles. Simultaneously another bottle is withdrawn from the light

Table II.

ALTERNATIVE DETERMINATION OF GROSS OXYGEN PRODUCTION. Temp. 19° C.

	Dissolved oxygen content. ppm.
Initial	8.17
24 hours in light	10.10
24 hours in dark	6.28
48 hours in light	18.36
24 hours in light followed by 24 in dark	9.39
72 hours in light	30.97
48 hours in light followed by 24 in dark	16.05
96 hours in light	46.20
72 hours in light followed by 24 in dark	24.50

Days	Gross oxygen production Y. Actual from above	Calc. from Eq. (4)
1	3.8	3.4
2	12.8	12.8
3	27.7	27.9
4	49.4	48.5

and covered. The dissolved oxygen of this covered bottle is determined after another 24 hours along with one which has been continuously exposed for 48 hours, and so on. No bottle is kept in the dark for more than 24 hours. The procedure may be symbolized as follows:

Method of incubation before analysis	Dissolved oxygen content detr.
None—start	1
24 hours exposed	2
48 hours exposed	3
72 hours exposed	4
24 hours dark	5
24 hours light and then 24 hour dark	6
48 hours light and then 24 hour dark	7

The gross oxygen produced up to 24 hours (Y) is (2 — 5).

The value of Y for the second 24 hours is (3 — 6).

The value of Y up to the end of 48 hours is therefore (2—5) + (3—6). Similarly the value of Y up to the end of 72 hours is (2 — 5) + (3 — 6) + (4 — 7).

Table II gives an example of the results of this procedure. The basic mixture was 50 ml. of a liquid containing much algae, 100 ml. of settled sewage and 7500 ml. of tap water. The equation was

$$\text{Log}_{10}Y = 0.53 + 1.92\ \text{Log}_{10}t. \qquad \text{Eq. (4)}$$

Agreement between experimental and calculated values in this type of experiment has always been so good as to suggest that the photosynthetic effect of this form of lighting per daylight cycle varies little over several days.

The foregoing relates to mixed algal cultures growing freely, which is the phase of possible application to sewage purification. Naturally this increasing rate of production cannot go on indefinitely and one could not expect it to continue in the face of approaching exhaustion of any essential nutrient. In fact, an initial accelerating rate has been followed by an abrupt decrease of rate on two occasions. In one instance the ammoniacal nitrogen content was low before the start of the test. In the other there was no clue as to which, if any, nutrient had failed.

Net Rate of Oxygen Production

Sometimes the net rate of oxygen production ($O_1 - O_o$ or Z) can be represented by an equation of type (3). For instance the data in example A in Table I can be represented by

$$\text{Log}_{10}Z = 0.07 + 1.97\ \text{Log}_{10}t. \qquad \text{Eq. (5)}$$

Table III shows that agreement between calculated and experimental values is good. This is not always so and the gross oxygen production Y seems more fundamental.

Oxygen Production in Constant Light

A 200-watt lamp was suspended a little above the floor in a large built-in cupboard and bottles were placed touching a circle drawn with the projection of the lamp on the floor as centre. Other bottles were wrapped in two layers of brown paper and kept a little further away from the light. The temperature was remarkably constant. Illuminated and non-illuminated bottles were withdrawn at intervals in pairs. For some hours after the start of a test the rate of oxygen production appeared almost constant but gradually the value of Y began to incline away from the time axis. Curiously the curves were not so smooth as in the experiments with daylight. In general the data proved amenable to the same mathematical treatment up to periods of 48-hour continuous constant illumination. The equations deduced were naturally applicable to any period of time.

Table III.

NET RATE OF OXYGEN PRODUCTION.

Days	Net rate of production Z. Actual ppm.	Calc. from Eq. (5) ppm.
1	1.20	1.18
3	10.33	10.23
4	18.12	18.02

Nature of the Organisms

The essential characteristic of the chlorophyll-containing organisms is that they produced oxygen freely in the light in a sewage containing much trade waste. Liquids have therefore been classified by their oxygen-producing powers. This was done with the knowledge that the activated sludge and other biological processes were developed to high degrees of technical efficiency before any but vague information was available as to the nature of the organisms concerned. In every kind of biological sewage treatment the organisms used have been developed in mixed culture from the sewage itself. As regards algae it is felt that in other fields too much energy has been devoted to identification and enumeration of species. The algae which spontaneously appear in sewage exposed to the light have been very small under the microscope. *Chlorella* and *Chlamydomonas* have been identified, but the cultures can hardly be anything but mixed.

The minute size of the organisms involved in this investigation is shown by the fact that practically all the green matter passes readily through Postlip 633C or B papers, and much green matter usually passes the Whatman No. 1 paper. On the other hand they appear to be completely removed by filtration through asbestos in the Gooch crucible.

The typical equation has been given as

$$Y = at.^b \qquad \text{Eq. (3)}$$

during the period of development. Differentiating

$$dY/dt = ab.t^{b-1} = \frac{bY}{t} \qquad \text{Eq. (6)}$$

That is, if daily variation in light intensity is eliminated where necessary, the rate of gross oxygen production is proportional to the quantity already produced and inversely proportional to the time elapsed.

Summary and Acknowledgment

The rate of production of oxygen by the freely developing mixed cultures of very small algae has been shown to be proportional to the quantity already produced and inversely proportional to the time elapsed.

Thanks are due to the Sewage Disposal Committee of the Nottingham Corporation for permission to publish this paper. The author is indebted to the Manager, Mr. A. R. Stone, for the necessary encouragement.

References

(1) Abbott, W. E., *Sewage Works Journal*, May 1948.

(2) Butcher, R. W., Pentelow, F. T. K., and Woodley, J. W. A., *Biochem. Journal* XXI, No. 4, 1927.

PRECONDITIONING AND DIGESTION OF SEWAGE SLUDGE

*The First of a Series of Articles from the Operator's Viewpoint**

I—Reducing Mineral and Water Content of Raw Sludge—Sludge Thickening

by

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THE CHESTER ENGINEERS
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TYPICAL sewage contains only 500 to 1,000 ppm. of total solids, or residue on evaporation. Thus, it is 99.9 to 99.95 percent pure water. Even Ivory soap only claims to be 99.44 percent pure. Furthermore, perhaps one-half of the "impurities" in sewage are of a mineral nature and entirely unobjectionable from a stream pollution viewpoint. All of the various types and designs of sewage treatment plants, from the smallest septic tank to the largest complex plant, with all its mechanical ramifications, are designed to simply remove part of this minute amount of organic matter, (approximately 0.05 percent) from the water and dispose of it.

Some of the impurities, both mineral and organic, are in suspension, and are large enough so that they can be removed by screening, sedimentation or flotation, i.e. primary sewage treatment processes. Other impurities are either in true solution, or too fine to settle out. Therefore, where a higher degree of treatment is required, more elaborate methods such as chemical coagulation, standard or high rate trickling filters, activated sludge, etc., are resorted to. To a large extent, these more elaborate methods of sewage treatment agglomerate, coagulate, or otherwise change these dissolved, colloidal, and very finely divided suspended matters into larger, flocculant solids that are finally removed by sedimentation in final basins.

Despite all the various methods that may be used alone, or in combination, for removing solids from sewage, there are really only two methods for disposing of the organic portion of those solids after they are removed—incineration or digestion. Burial might be considered a third method, but in the final analysis, burial is just another means of accomplishing digestion.

The more common means of effecting digestion are in septic tanks, in Imhoff tanks, in separate digestion tanks—either heated or unheated, and in lagoons. Before this series is completed, operation of some or all of those devices will be discussed, but the point to be made here is that *digestion is a means of disposing of organic solids.* Therefore, from a theoretical viewpoint, *it would be desirable to feed only organic solids to the digestion process—not water and not mineral solids.*

The Author

From a practical viewpoint it is, of course, impossible to exclude all mineral solids or all water, but sludge conditioning ahead of digestion is concerned principally with limiting the amount of water and mineral matter reaching the digestion process, regardless of what type of structure is used for digestion.

Reduction in Mineral Matter Reaching Digestion

Grit has no place in the digestion tank or compartment. It not only occupies valuable space that might better be used for digestible material, but there is grave danger that it will settle and compact around sludge draw-off pipes so that they become clogged; in digesters equipped with slow moving arms that mechanically rake and stir the bottom sludge, excessive grit may so overload those mechanisms that it becomes necessary to either discontinue their use, or draw sludge more frequently, and after a shorter digestion period, than would otherwise be necessary.

Grit usually reaches the plant through the incoming sewer, and if the plant is not provided with a grit chamber, then there isn't much an operator can do about it except use his influence with the "powers that be" to have one installed. If he does have a grit chamber, however, he should study its performance so as to make it as effective as possible. Frequently minor changes in inlet or outlet baffles, or weirs, will materially increase the efficiency of any grit chamber. It should be obvious that if the grit chamber is designed for hand cleaning, then the operator must clean it as often as necessary to insure its effectiveness being maintained.

Sand, or stone dust, may be present in the effluent from trickling filters. It may come from a new filter filled with improperly washed and screened media, or from any filter in which the stone is gradually disintegrating. Of course, the cause of the trouble should be determined and corrected but, in the meantime, the final settling tank sludge should be pumped back to the raw sewage ahead of the grit chamber so as to remove as much of the mineral matter as possible before the sludge reaches the digestion compartment.

While grit is probably the most objectionable mineral matter in raw sludge entering the digester, *excessive amounts of even finely divided mineral matter tends to retard digestion.* If raw sludge with an initial organic, or volatile, content of 75 percent is introduced into a properly functioning digestion compartment, we might expect that 75 percent of that organic material would be digested. If the initial volatile content were 65 percent, we would expect only about 55 percent of it to be digested. Sludge with an initial volatile content as low as 53 percent has been digested but a reduction of only 30 percent in the volatile matter was obtained. It seems doubtful if raw sludge with a much lower organic (higher mineral) content would digest

*Based on lectures before the Short School for Sewage Works Operators at Penna. State College.

Grit Collectors and Mechanisms to Remove It Are Essential to Reducing the Mineral Content of Sludge

at all, for even thoroughly digested sludge will normally contain at least 40 to 45 percent volatile matter.

Excessive mineral matter of a fine, non-grit like character in the raw sludge may originate from certain industrial wastes (tannery wastes for example) or from the resettling of poor digester supernatant liquor. In 1947 at Butler there was bad supernatant for several weeks. Table I compares the results obtained during that period with the period immediately following it.

While there may have been some contributing factors, the data clearly show the deleterious effect on digestion of dilution of the organic matter in the raw sludge with excessive mineral matter, even if that mineral matter is from digested solids such as can be expected from the sedimentation of a bad digester overflow liquor. The control and disposal of digester overflow liquor will be discussed later on. It was mentioned here just to illustrate the importance of excluding excessive mineral matter from the digestion compartment, regardless of what its source may be.

Reduction in Water Reaching Digestion

If digestion is effected in septic tanks or Imhoff tanks there is little or nothing the operator can do to control the moisture content of the raw sludge, and so his conditioning problem consists almost entirely of limiting the mineral content, particularly the grit content, of the sludge. If digestion is to be accomplished in separate tanks or lagoons, however, it is even more important to limit the amount of water delivered to those basins.

Although sludge containing as little as 70 percent moisture will digest readily, it is not practical to obtain a raw sludge with a moisture content that low. Primary sedimentation sludge, free from grit, ordinarily ranges from 92 to 96 percent moisture, but runs as high as 98 percent in some cases. The humus-like sludge from final settling tanks following standard trickling filters usually ranges from 94 to 97 percent moisture, while excess activated sludge usually ranges from 98 to 99.5 percent moisture or even higher. Sludge from settling tanks following high rate trickling filters has a moisture content intermediate between the humus sludge and excess activated sludge. In order to reduce the moisture content of the excess activated sludge, it is frequently pumped to the raw sewage and allowed to settle out in the primary settling tanks in combination with the crude solids. The resulting mixed sludge usually has a moisture content of 96 to 98 percent. (This procedure will be discussed in detail in a later section.) The moisture content of chemically precipitated sludge varies so widely with the kind and quantity of chemical used that no average figures can be given.

At first thought, it may not seem important to worry about whether the raw sludge contains 94 or 96 percent moisture, but stop and consider that the one sludge has 6 percent solids and the other only 4 percent. For typical sewage sludges, in which the specific gravity of the solids is reasonably close to that of water, the volume occupied by a sludge containing a given weight of solids is practically inversely proportional to its solid content. The approximate formula may be written

$$\frac{V_1}{V_2} = \frac{S_2}{S_1}$$

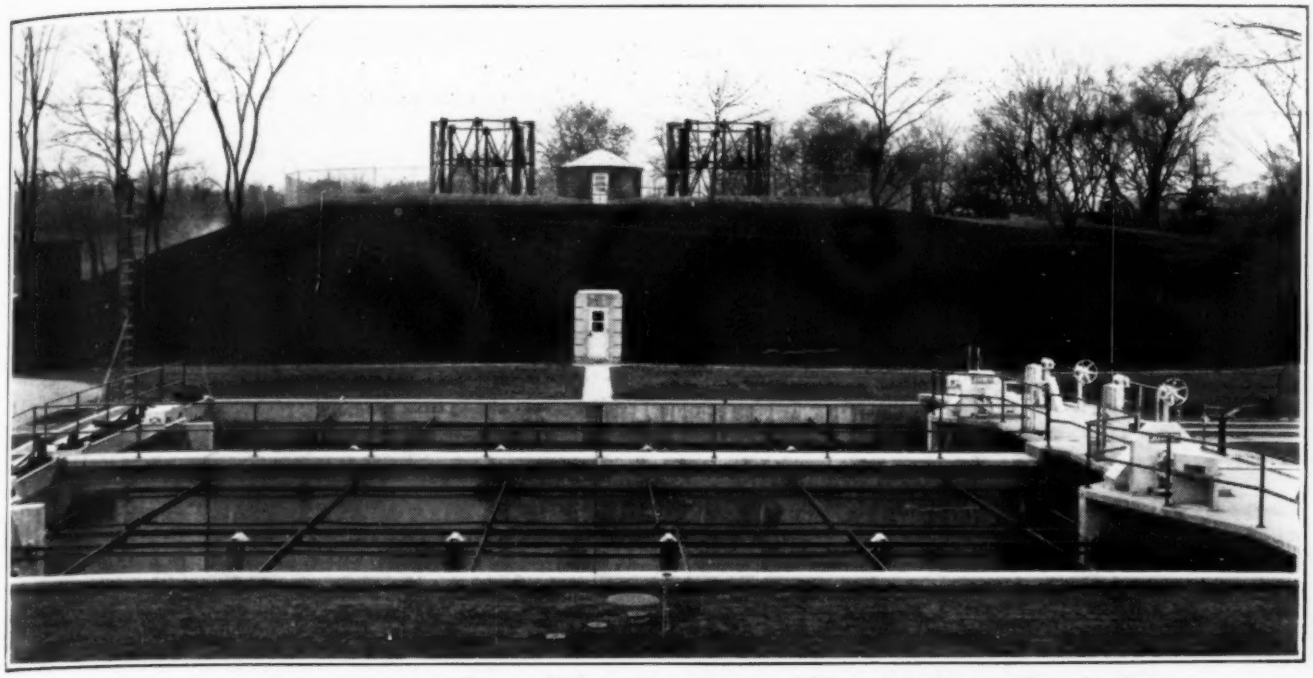
where V_1 is the volume occupied by a given sludge of S_1 percent solids and V_2 its volume after its percentage of solids is changed to S_2. Thus, the 96 percent moisture (4 percent solids) sludge would occupy 1½ times as much space as would a 94 percent moisture (6 percent solids) sludge containing the same *weight* of solids.

Digestion is, at best, a long drawn-out process requiring weeks, if not months, for completion. Few if any plants have such large digestion tanks that this increase in volume, occasioned by increased moisture content, can be safely ignored. Even if ample digestion space were available, the pumping of excessive volumes of raw sludge into the digester would cause a corresponding increase in digester overflow, or supernatant liquor, to be handled through the balance of the

Table I

Results Obtained In Digester Operation At Butler, Pa.

Period in 1947	June 1 to Sept. 27	Sept. 28 to Dec. 20
Digester Supernatant to Primary Clarifiers		
Total Solids, Maximum	5.11%	0.93%
Total Solids, Minimum	1.61%	0.15%
Total Solids, Average	3.19%	0.28%
Average Volatile Content of Solids	52.3%	49.6%
Raw Sludge Pumped to Digester		
Total Solids, lb. per day	5660	2835
Volatile Solids, lb. per day	3340	2117
Volatile Solids, percent	59.0	74.5
Gas Produced		
Cu. Ft. per Day	29,200	33,100
Cu. Ft. per lb. Volatile Solids Added	8.73	15.65



Primary Settling Tanks Equipped to Remove Sludge with a Minimum of Water Make Digester Operation Better

plant. Such liquor is always a problem. If the digestion tanks are to be heated, it is doubly important to keep the moisture content, and hence the volume, of the raw sludge at a minimum in order to reduce heat requirements.

To control the moisture content of raw sludge, it is absolutely essential to be able to see the sludge being pumped. If there is no observation point, it is suggested that the operator at least tap a sampling valve into the discharge line from the sludge pump. It should not be smaller than 1½ in. to avoid clogging and should discharge to a funnel, or sink, connected to a good drain so that the valve may be left open continuously if so desired.

Another practically necessary item is a positive displacement pump to withdraw sludge from the sedimentation basin. Centrifugal pumps or gravity withdrawal lines tend to deliver the greatest volume when the sludge is thinnest, while just the reverse condition would be ideal. When sludge is removed at a rapid rate, excessive water is often sucked through with it. Therefore, positive displacement pumps should be operated at low capacities, i.e. short stroke. Careful and continuous manipulation of a discharge valve, however, can overcome this drawback to gravity or centrifugal pump withdrawal if the sludge being drawn can be observed by a man stationed at that valve.

The most obvious, and sometimes the only, way of reducing the moisture content of the raw sludge is to allow it to build up and concentrate in the sedimentation basin. This is more effective in cold weather than in warm, because there is less chance of the sludge becoming septic and being lifted to the surface by gas. If this method is to be used, it is advisable to keep mechanical sludge removal equipment operating continuously. By so doing, the sludge is agitated enough to permit some of the gas to be liberated before it accumulates in quantities sufficient to buoy up large masses of sludge. While this method of thickening sludge may be of some help in operating digesters, it cannot be recommended because of the grave danger of impairing the quality of the settling tank effluent.

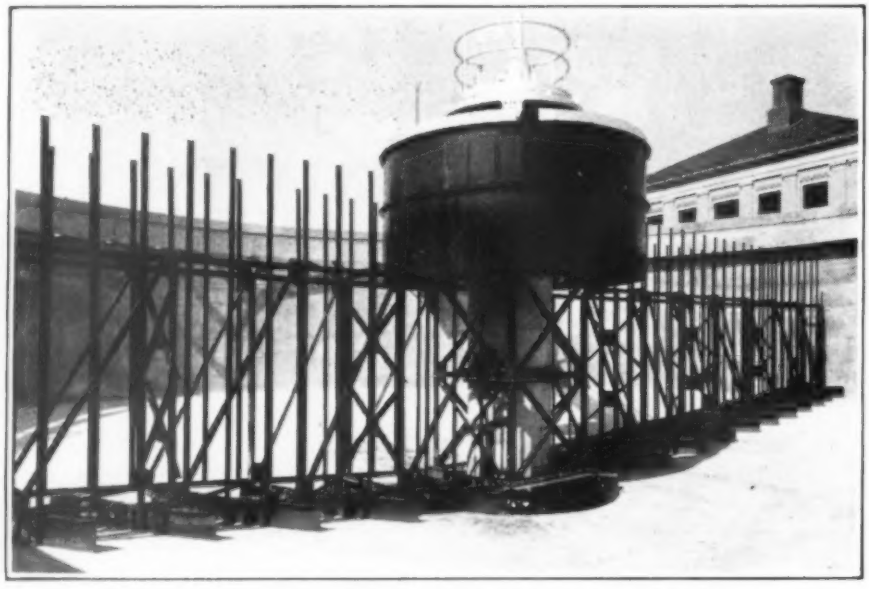
Usually, if the operator wants to completely free his settling tanks from sludge, he has no other alternative than to operate his sludge pump until he observes its discharge to be only a dirty water. This may result in introducing considerable excess water into the digesters, particularly if the sludge pumps are rather remote from the settling tanks. While operating the Grove City plant the writer devised a simple means of partially overcoming this difficulty. There the primary clarifiers were typical rectangular tanks with Link-Belt chain and flight, sludge removal equipment. The sludge collection hoppers at the inlet end were about 8 ft. deeper than the rest of the tanks.

Simple hand operated pitcher pumps were installed over each hopper that took their suction from a point 6 ft. above the bottom of the hoppers, i.e. 2 ft. below the floor of the main portion of the tank. While pumping sludge from the bottom of the hoppers directly to the digester with the Barnes motor driven piston pump, the operator worked the pitcher pump by hand. As soon as the pitcher pump drew clear sewage, the Barnes pump was shut down even though it was still delivering a fairly heavy sludge. This simple procedure reduced the volume of sludge pumped to the digester 25 to 30 percent during the winter months, but during the summer there was some trouble with rising of gas buoyed sludge from the hoppers.

By far the best way of controlling the moisture content of the raw sludge involves the use of a separate tank. These separate tanks need not be very large. There are two types of tanks; one is a simple tank with no mechanism provided with multiple-valved decanting outlets at various levels, which the author calls "sludge decanting tanks"; the other type is quite similar to a mechanically cleaned sedimentation basin, though considerably smaller; it is generally known as a "sludge thickener." With either type, it is possible to withdraw as much sludge from the settling basins as is necessary to keep them clean without paying such close attention to rates and duration of sludge withdrawals. Now to consider the operation of these tanks.

Sludge Decanting Tanks

These tanks should have a capacity of at least one-third to one-half the maximum daily volume of sludge they are expected to withdraw from the sedimentation basin. Tanks of considerable depth and relatively small cross section are desirable. They should be provided with a number of, say 2 in.,



Sludge Thickener Reduces Moisture Content of Sludge to Digesters

valved outlets located at 1 to 2 ft. spacings vertically along one side. All of these outlets must lead to an open gutter or sump so that their discharges may be observed. Sludge is withdrawn from the sedimentation basins to the decanting tank, by gravity or pumping, until the basins are free from sludge. The contents of the decanting tank are allowed to stand quiescent for four hours or longer during which time it concentrates and a relatively clear supernatant liquor appears at the top. This liquor is then drawn off through one or more of the 2-in. side outlets, and returned to the incoming raw sewage. After all of the supernatant liquor has been decanted in this manner, the remaining sludge is pumped to the digestion tank.

The use of such a tank was initiated at Butler early in 1940. Table II illustrates its effectiveness in that instance.

The trickling filters were new at Butler in 1940. Although they were in use all year, the final sedimentation basin was not ready for use until late in the fifth period. When it did go into service, sludge from it was pumped back to the raw sewage. The volumes of primary basin sludge shown for the second to fifth periods inclusive are typical of the volumes it had always been necessary to pump when operating as a primary plant. The results for the fourth and fifth periods indicate that, at Butler, the use of a decanting tank reduced the volume of primary sludge about 60 percent. At some other plant where a sludge of higher initial solid content could be withdrawn from the primary basins, the reduction might not be so great.

After the final sedimentation basin went into operation, pumping the humus sludge to the decanting tank was tried at first, but that sludge did not concentrate materially in the time available; hence the decision to pump all humus sludge back to the raw sewage. Just at the time the secondary tank went into operation the trickling filters were unloading and so the amount of humus sludge solids was quite high. Those two conditions together account for the relative ineffectiveness of the decanting tank during the sixth period. But even then it reduced the sludge volume 20 percent which, in the author's opinion, was a very worthwhile reduction. The results obtained during the seventh to twelfth periods inclusive (20 weeks) indicate that the decanting tank effected about a 40 percent reduction in the mixed humus and primary sludge pumped from the primary basins.

Prior to the installation of trickling filters at Butler it had been the practice to use chemical coagulation during the summer months. Alum, chlorinated copperas, or a combination of the two, were used as coagulants. The volume of sludge produced was about 60 percent greater than was collected from plain sedimentation alone. The sludge had a solid content of about 4.7 percent and averaged about 68.9 percent volatile matter. Repeated tests were made of that sludge in liter graduates to determine whether or not decanting would be effective in reducing its volume. Those tests indicated that there would be little or no concentration in 4 to 6 hours standing and so decanting would be impracticable. Sludges from other chemical combinations, and other sewages, might behave differently. These tests are mentioned simply because any operator can easily make them on his own sludge and thus find out *in advance* whether or not the installation of a decanting tank would be of benefit to his particular plant.

Before leaving the subject of decanting tanks it should be noted that Rudolf [1]* presents data to show that sludge continues to concentrate throughout holding periods up to 48 hours, but that the greatest concentration occurs during the first 12 hours. To use a long holding period it would be necessary to have more than one decanting tank. At Butler it appeared advisable to pump sludge from the primary basins every 8 hours. Since we have only one decanting tank this automatically limits the holding period to 4 to 6 hours. Quite possibly a longer period would produce greater concentration, but it would also increase odors and might materially reduce the pH and alkalinity of the sludge.

Table II

RESULTS WITH SLUDGE DECANTING TANKS AT BUTLER, PA.

4 Week Period of 1940	Sludge from Primary Basins cu. ft./day	Sludge to Digestion Tank			Reduction in Sludge Volume Due to Use of Decanting Tank
		cu. ft./day	% Solids	% Volatile	
2	1980	1980	1.7	74.1	.....
3	1693	1693	2.1	72.4*	.....
4	2007	681	3.8	77.3	66%
5	2298	986	3.6	78.1	57%
6	2503	2006	4.6	66.5	20%
7	2423	1436	4.1	69.1	41%
8	2310	1398	4.6	67.8	40%
9	2302	1352	4.3	78.2	41%
10	2435	1502	4.0	75.4	38%
11	2550	1508	4.3	77.0	41%
12	2405	1419	4.1	74.6	41%

Sludge Thickeners

So far as the writer knows these tanks have only been installed at activated sludge plants and even there their use is rather uncommon. The literature makes some reference to their use at Los Angeles [2], Phoenix, Ariz. [3], Topeka, Kan. [4], Baltimore, [5], Tallman's Island, New York, [6] and Bowery Bay, New York, [7]. The earliest one was at Los Angeles and the others have been installed in the order named. In general, the tanks have been center fed, radial flow, sedimentation tanks with circumferential outlet weirs and equipped with Dorr Co. mechanisms. The tanks range from 9 ft. depth at Phoenix to 18 ft. at Tallman's Island.

*References will appear in a consolidated bibliography following the final article in the series.

Table III

THICKENER OPERATION WHEN HANDLING ACTIVATED SLUDGE

Plant	Los Angeles	Los Angeles	Phoenix*	Phoenix	Phoenix*	Phoenix	Topeka*	Topeka
Source of Influent	Mixed Liquor	Return Sludge	Mixed Liquor	Mixed Liquor	Return Sludge	Return Sludge	Return Sludge	Return Sludge
% Solids Influent	.....	.....	0.17	0.20	0.733	0.627	0.50	0.336
Settling Rate, gal. per sq. ft. per day	600*	169**	178*	74	56*	22	366*	163
Detention Period, hr.	.....	.....	9.1*	22.0	28.9*	73.1	5.0*	11.2
% Solids in Thickened Sludge	5.2	2.3**	3.6*	4.52	3.2	4.39	3.5*	2.3
Lb. Solids Handled per day per ft. of thickener, vol.	.....	.....	0.280*	0.135	0.380*	0.127	1.510*	0.475
Chlorine Used								
ppm on Influent	50	0	28*	59	120*	236	nil	nil
Lb. per 1000 lbs. Solids Handled	.....	.....	16.7*	50.8	16.5*	37.8	nil	nil
Length of Run	9 mo.	?	12 day*	6 mo.	8 day*	26 day	14 day*	1 yr.
Suspended Solids in Eff.								
ppm	.....	.....	28*	.....	40*	.....	.....	.....
Lb. per day	.....	.....	40*	.....	18*	.....	.....	.....
B.O.D. of Effluent								
ppm	.....	.....	28*	.....	125	.....	.....	.....
Lb. per day	.....	.....	42*	.....	46*	.....	.....	.....

*These figures represent approximate maximum thickener loadings; other figures represent typical routine operation.
**Fill and draw operation; all other figures are for continuous flow.

The mechanisms are similar to ordinary Dorr clarifier equipment except that they have a number of closely spaced vertical "pickets", i.e. about 2-in. angles. These pickets extend from the sludge collecting arms up to within 2 or 3 feet of the liquor surface. In some cases the thickener inflow is mixed liquor drawn directly from the aeration tanks, while, in other cases, it is return sludge drawn from the final clarifiers. In either event, its rate of inflow to the thickener should be as uniform as possible throughout the day, and as low as compatible with wasting the necessary amount of activated sludge solids. Sludge withdrawal should also be practically continuous and its rate should be varied so as to maintain a sludge depth almost as great as the height of the pickets.

In most cases chlorine is fed either to the top liquor in the thickener or directly to the thickener inflow in order to retard biological action in the deep sludge accumulation. Table III summarizes the operating results obtained at the first three named plants.

Keefer [5] reports that at Baltimore the thickeners were fed with return sludge averaging 0.97 percent solids and produced a thickened sludge of only 1.8 percent solids, but he also reports a reduction in sludge volume of about 84 percent due to use of the thickener. Obviously something is wrong with one or the other of those figures.

Donaldson [6] reports that at Tallman's Island the thickener is fed with return sludge containing 0.51 percent solids and produced a sludge containing 3.48 percent solids. He also reports that at Bowery Bay the thickener is fed with mixed liquor containing 0.16 percent solids and produced a sludge containing 2.4 percent solids. Chlorine was used at all three plants.

The overflow from the thickeners at the various plants has been (a) returned to the raw sewage, (b) returned to the aeration tanks, and (c) discharged with the plant effluent. At Topeka and Phoenix the thickener was sometimes used for treating poor supernatant liquor, or for concentrating mixed sludge drawn from the primary clarifiers, as well as for dewatering waste activated sludge solids. In the author's opinion, thickeners would be found very useful at many plants but, since they are not commonly provided, we are not warranted in discussing the details of their operation at this time.

(The second installment in this series will appear in an early issue.)

SALT LAKE'S SEWAGE PROBLEM UNIQUE

The germicidal properties of the world's largest inland body of salt water, Great Salt Lake, has become the focal point of a sewage controversy in Salt Lake City.

For many years, Salt Lake City has dumped sewage into the northern end of the lake via an open canal. About a year ago agitation was begun among city health officials for the building of a sewage treatment plant. A well-known consulting engineering firm of Chicago, Greeley and Hansen, was retained to study the advisability of continuing to dump municipal sewage in the lake in the face of an increasing population. The firm's report concluded that the lake's bacteria-killing properties were sufficient, and that Salt Lake City's sewage could be emptied without fear of bathing beach contamination.

Recently the Utah State Board of Health surveyed Salt Lake's sewerage system and issued a sharply contradictory report. R. A. Hart, engineer member of the board, reported that contrary to general belief, the water of Great Salt Lake is becoming highly contaminated. The board's studies revealed that disease-bearing organisms can remain alive in the lake for as long as 32 hours.

The report further contends that the sewage water of lower gravity tends to float on top of the lake brine; and, since the prevailing winds are from the northwest, it is conceivable that sewage can make the journey from the point of entry on the north shore to bathing beaches and salt refining plants on the south edge in a few hours. This, if true, would leave as much as a day of life for the disease bearing organisms to come in contact with bathers or into the vats of the salt plants.

A thesis issued in 1924 by a University of Utah scientist, Elfriede Frederick, was cited by the Board of Health in the matter of contamination. This report stated, in part, "There is basis for the contention that the lake water is noticeably germicidal; but, micro-organisms, including pathogens, remain viable for some time. The water of the lake is not the best, or even as good as it should be for bathing purposes."

The waters of the lake are approximately seven times as salty as ocean water and contain only one unicellular living organism. This gave rise to the common belief that bacteria could not survive in it.

Although pathogenic bacteria have never actually been found in the area of the bathing beaches, contamination fears stem from the belief that the water could not accommodate the greatly enlarged volume of sewage occasioned by Salt Lake City's post-war growth. The recent industrialization of the area in the vicinity of the sewer canal outlet has been another factor in the agitation for remedying the pollution situation.—*Steve Gilman.*

UNIQUE SLUDGE DIGESTERS

Serve the Niers District in Germany

by
C. E. KEEFER
Deputy Sewerage Engineer
BALTIMORE, MD.

A RECENT issue of *Gesundheits Ingenieur* contains an article by Franz Schmitz-Lenders, describing the construction and the operation of two sludge digestion tanks in the Niers District in northwestern Germany that are unique for their great size. They have been in operation since 1938 and serve the cities of M. Gladbach, Reydt and other communities.

Design

Each tank is 88 ft. 5 in. high and has an outside diameter of 75 ft. 6 in., with a gross capacity of 334,000 cu. ft. and a working capacity of 327,300 cu. ft. A sheet-metal gas dome with a volume of 56,500 cu. ft. surmounts each tank and projects into an annular ring filled with water at the outer edge at the top of the tank. There are 12 glass observation ports in the gas dome for inspecting the interior of each tank together with four searchlights for observation purposes. Although these lights were used for a time, they eventually had to be abandoned, as it was impossible to keep the glass windows through which the lights shone clean, even though water sprays and wipers were used. At present strong sunlight is of some help when observing the surface of the sludge.

On the gas dome of each tank there are 16 ball-jointed spray nozzles for breaking up scum. Each nozzle is 16 in. long with a discharge opening of 1 in. Nozzles with smaller openings were tried but were unsatisfactory as they became clogged. Supernatant sludge liquor, which is kept under pressure by a centrifugal pump, serves as spray water.

Raw sludge is introduced into one of the tanks through an 11.8-in. pipe by means of a reciprocating pump with a capacity of 881 gpm. The sludge flows into either of two cup-like structures, one above the other on the vertical center line of the tank. One is 12 in. below the surface of the sludge and the other is approximately 29 ft. above the tank floor. The piping is arranged so that sludge can be drawn from or pumped into either of these receptacles. Sludge is withdrawn from the tanks through four 9.8-in. pipes, the inlet ends of which terminate just above the tank floor. If necessary, scum can be pumped from the digesters by withdrawing it from the upper of the above-mentioned cup-like structures. The tanks are heated by the introduction of superheated steam into the raw sludge pipe entering the tanks.

Operation of Tanks

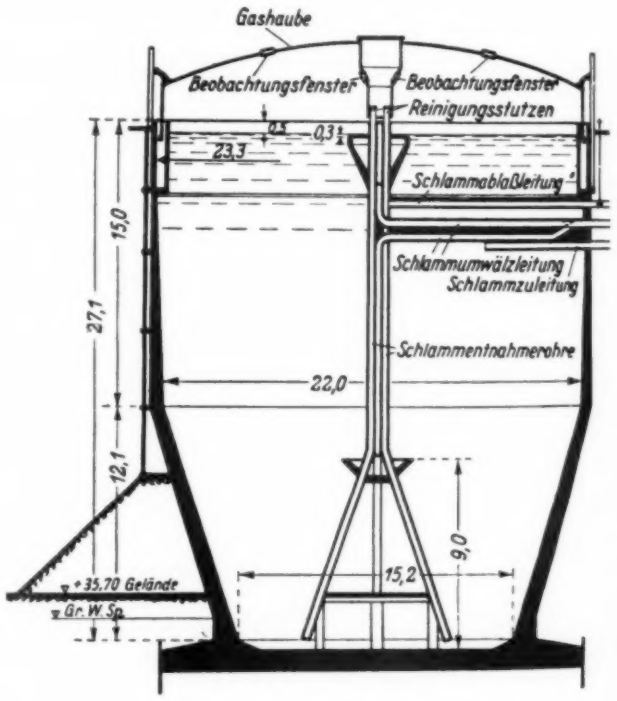
The tanks are operated in series. The sludge added daily to the tanks amounts to 52,840 gal. and contains 7.4 per cent of dry solids (16.35 tons daily). The raw sludge contains 58.6 per cent organic matter on the dry basis. The temperature of the sludge is raised from a yearly average of 58° F. to 80° F. The quantity of superheated steam used amounts to 11,910 lb. daily. The water content of the sludge is increased 2.8 per cent by the condensate formed. The following is the heat required to maintain a temperature of 80° F. in the primary tank.

Temperature 22°F	402,300 Btu. per hr.
Heat loss from tank	241,800 Btu. per hr.
Total heat added	644,100 Btu. per hr.

The sludge is retained in the primary tank for an average of 41 days. The second tank, which is heated entirely by the sludge flowing from the primary tank, has a yearly average temperature of 73° F.

Schmitz-Lenders indicates that the methods used in heating these tanks have a number of advantages. In the first place, the hot steam is introduced into the incoming raw sludge and not directly into the digestion tank. Consequently, the action of mesophilic bacteria in the tank is not retarded. As steam is used for only 9 hr. daily, considerable heating capacity is available in case more sludge is handled or a higher temperature is desired in the digesters. As the incoming heated sludge is hotter and is less dense than the contents of the tank, there is no danger that it will sink to the bottom of the digester and be drawn off with the ripe sludge.

Schmitz-Lenders concludes that these two digesters, which contained no mechanical equipment and were not heated by a heat exchanger, have proved their worth by having given successful service for a period of ten years.



Cross-section Through Left Digester

(Translate German words as follows: Gashaube—gas dome; Beobachtungsfenster—observation window; Reinigungsstutzen—clean-out; Schlammablableitung—sludge discharge pipe; Schlammumwalzleitung—sludge circulating pipe; Schlammzuleitung—sludge inlet pipe; Schlammentnahmeröhre—sludge withdrawal pipe; Gelände—ground level; Gr. W. Sp.—ground water level. Dimensions are given in meters; 1 meter = 3.281 ft.)

A.S.C.E. SANITARY ENGINEERING DIVISION MEETING IN NEW YORK

Holds Three Sessions and Joint Meeting with N.Y. State Sewage Works Assn. and N.Y. Section A. W. W. A.

THE SANITARY Engineering Division of the American Society of Civil Engineers held three sessions as part of the A. S. C. E. 96th Annual Meeting in New York in late January. In addition, the Sanitary Engineering Division was a joint participant in the meeting of the N. Y. State Sewage Works Assn. and joined with that association and the N. Y. Section of the A. W. W. A. for a luncheon on the last day of the meeting. All sessions were well attended.

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Bryn Mawr, Pa.

New Officers

This meeting was presided over by the retiring chairman, Harry M. Freeburn, Chief Engineer of the Philadelphia Suburban Water Co. of Bryn Mawr, Pa. The Executive Committee meeting elected new officers and in view of the recent death of executive committee member Raymond F. Goudey, who would have become Chairman for the ensuing year, the Executive Committee elected John H. O'Neill, Director of the Division of Public Health Engineering of the State Department of Health, New Orleans, La., to the chairmanship.

To take Mr. Goudey's place on the Executive Committee for the term ending 1951, the committee selected Ray L. Derby, Sanitary Engineer of the Los Angeles Water and Power Department. Other members of the Executive Committee include A. H. Wieters, U. S. Public Health Service, Washington; F. W. Jones, Consulting Engineer of Cleveland, and Professor R. H. Suttie of Yale University.

Cold Weather Problems

The first technical paper of the sessions was on "COLD WEATHER SANITARY ENGINEERING PROBLEMS" presented by W. A. Hardenbergh, Editor of *Public Works Magazine*, New York, N. Y.

Col. Hardenbergh spoke of many of the problems which appear in the cold weather areas, such as Alaska and the Arctic Circle. Permafrost is one of the problems, which has not yet been solved, but Col. Hardenbergh believes that other sanitary engineering problems can be solved. He said that additional knowledge was needed, however. We need to know more about the treatability and quality of surface waters of the area and we need further information on chlorine demand and chlorination reaction at low temperatures, as well as information on insulation properties and heat conversion.

Col. Hardenbergh concluded that field equipment suitable for water and waste disposal under very low temperature conditions must be developed and standardized. Perhaps a clearer definition of the service required must be made. When there is a better idea of what the Arctic conditions are going to be, Col. Hardenbergh believes that the sanitary engineering problems of the cold weather areas can be solved.

Sanitary Engineers in the Armed Service

A paper on "THE STATUS AND OPPORTUNITIES FOR SANITARY ENGINEERS IN THE ARMED SERVICES" prepared by Clarence W. Klassen, Chief Sanitary Engineer, Illinois Department of Public Health, Springfield, Ill., was presented in Mr. Klassen's absence by Lloyd K. Clark, of Washington, D. C. After defining a sanitary engineer, both as to technical education and experience, Mr. Klassen's paper pointed out that a sanitary engineer today not only controls water and sewage works, but also has important functions in public health and environment. He has interest, in addition to water and sewage, in garbage, foods, swimming pools, laboratory testing, camps, schools, etc., etc.

Although there is a distinct need for trained men in sanitary engineering for service in the Army and Navy, it is presently impossible to find ways to use these abilities to the fullest extent. While the objectives of the medical corps may be the same as sanitary engineering corps, the paths to obtain their objectives are entirely different and therefore the sanitary engineering corps should not be a part of the Medical Service Corps. Mr. Klassen pointed out that, in World War II, many sanitary engineers did not have engineering duties, and that at the present time in the Army there is no professional status for sanitary engineers, a condition which calls for reorganization. While the opportunities may be unlimited for their service, their status is definitely chaotic.

Programmers

M. D. Hollis
Asst. Sur. Gen.
U. S. P. H. S.
Washington, D.C.

L. K. Clark
Proj. Mgr.
Assn. Amer. R.R.
Washington, D.C.

In the discussion of this paper, Col. W. A. Hardenbergh, who commanded the Sanitary Engineering Corps in the last war, pointed out that there are now sixteen sanitary engineers in the Medical Service Department. He called attention to the fact that in the Army there are only three professional groups recognized —these are the doctors, dentists and veterinarians, as the first group, the judge advocates or lawyers as the second group, and the clergy as the third group. Engineers are not recognized to have professional status and therefore can be assigned to any type of duty.

Federal Pollution Control

"FEDERAL WATER POLLUTION CONTROL ACT AND THE U. S. P. H. S. PROGRAM" was the title of a paper presented by Mark D. Hollis, Assistant Surgeon General and Chief

Sanitary Engineer of the U. S. Public Health Service, Washington, D. C. Mr. Hollis reviewed briefly the history of Public Law 845 and pointed out that at the present time there was no money available for operations under that law. He described the division of the administration between the Public Health Service, which is to determine the extent of the pollution control needed, and the Federal Works Agency, which is to administer the funds for any construction called for. Mr. Hollis reviewed the regulatory provisions of the law, the provision for loans and grants and the Cincinnati laboratories. All of these items have been discussed in this magazine heretofore.

Mrs. Hollis called attention to the fact that since V-J Day building had been limited, because of high costs and scarce materials. He pointed out that in 23 states, which contained less than 40 per cent of the population, there had been developed $750,000,000 worth of plans of critically needed work. It is estimated that for the entire country more than two billion dollars worth of critical pollution abatement works are needed.

The Stream Control Division of the Public Health Service will develop flexible classifications of streams, depending on changes in population, industrial wastes, etc. These will be developed in fourteen river basins which are now being set up.

Federal Works Agency Program

J. W. Follin, Assistant Administrator of Federal Works Agency, Washington, D. C., presented the last paper in the first session. His paper dealt with "The Federal Works Agency Program." Mr. Follin called attention to the abatement of water pollution as the No. 1 national problem and he, too, estimated that the cost of it would be between two and five billion dollars total. He also emphasized the fact that the passage of Public Law 845 doesn't mean that the Federal Government has decided to shoulder the responsibility, but he did detail the administration by which the Public Health Service would determine the need of pollution abatement and the Federal Works Agency would fill the need.

Mr. Follin detailed the procedures for obtaining loans and grants, told how much was available in the bill for each and what the proposed appropriations are. He stated that because of the loan and grant feature there would be a discouragement of joint facilities for small municipalities, and he also thought that the limitations on not only the budget, but on the amount set up, would delay rather than expedite the work on it. In addition to telling how to obtain applications and process them, Mr. Follin called attention to the size of the job which makes it both important and big, and he mentioned that as of June 30, 1947, 1,383 sewage disposal projects had been planned under the Bureau of Community Facilities in the FWA. These total $10,700,000 for plans and specifications at a total estimated cost of $400,000,000; about one-half of these plans have been completed and ready for bids. Only 86, however, are actually under contract—most of these for projects under $1,000,000. This provides a small, but reliable, start towards the fight on pollution.

S. A. Greeley, Cons. Engr., Chicago, Ill., pointed out that in both of these papers there had been expressed a liberality of approach, but neither paper expressed rigidity with regard to standards and desires. Mr. Greeley believes that this is not only good but the proper approach. We need tolerance to take advantage of new processes as advances in knowledge are made.

Rate Structures

Reporting as Chairman of the "Committee on Fundamental Considerations in Rates and Rate Structures for Water and Sewage Works," S. A. Greeley, Cons. Engr., Chicago, reviewed the history of the activity of the committee and told how that committee was cooperating with similar committees and representatives of a number of other societies and associations.

The formation of the committee to study rates began to take form following a meeting of a Section on Municipal Law of the American Bar Assn. in September, 1947. A committee in the Municipal Law Section was set up to cooperate with similar committees in the American Society of Civil Engineers, which consists of E. H. Aldridge, T. J. Blair, C. H. Daring, F. S. Friel, E. J. Schropfer and G. P. Steinmetz. In addition, the American Water Works Association and the Federation of Sewage Works Associations, the American Public Works Association, and a Municipal Finance Officers' Association all have representatives to work on this problem.

A meeting held on October 15th-16th last year by representatives of all these groups outlined the scope of the study and decided that it should be limited to fundamental considerations only, and should include financing, as related to rate structures, both matters being related to private and public utilities.

A tentative statement of objectives included four points: 1. Whether or not, and how a rate structure can be computed that will fairly allocate the contributions of persons and property to the necessary annual revenue on the basis of benefits and costs. 2. The consideration of what constitutes the total revenue requirement to which the rate structure applies and its effect on the rate structure. 3. A review of the constitutional and statutory considerations and influences that affect rates and rate structures and related financing and interpretation of the courts thereon. 4. A report useful to those undertaking the instituting and administering of, or having jurisdiction over, water and sewage works rates and rate structures and related financing.

Calling attention to one author's statement that rate structures generally appear to have been determined on almost every basis except the proper one, Mr. Greeley briefly explained the early statements and considerations which prompted the organization of this joint undertaking and resulted in the above named objectives. He expects that at least two years will be required to complete the study and the report.

Advancement of Sanitary Engineering

A progress report of the "Committee on the Advancement of Sanitary Engineering" was presented by Herman G. Baity, School of Public Health, Univ. of North Carolina, Chairman of the Committee.

Among the various topics presented and discussed by Prof. Baity were Trends in Sanitary Engineering and Education, Industrial Hygiene, Public Health Engineering, Environmental Sanitation, Sanitary Engineering in Governmental Agencies, and Sanitary Engineering in the Military Services, about which Prof. Baity agreed with the speaker of the previous day that, under present conditions, there is no incentive to draw qualified personnel into the Armed Services or to build a competent sanitary organization in any one of them—a situation which is serious in peace time and will prove calamitous in time of war.

Also discussed by Professor Baity were Sanitary Engineers in Consulting and Commercial Organizations, New Fields of Sanitary Engineering, which include such problems as bio-

logical warfare and nuclear fission, Industrial and Commercial Needs, etc.

In concluding, Professor Baity stated that the sanitary engineer must sell his services on merit, but that, unfortunately, as a group, they had divided allegiance. Sanitary engineers have no single professional home. He called upon the sanitary engineering division of the A.S.C.E. to act as a "stimulating and motivating agency in effecting joint action of representatives of various organized groups in the sanitary engineering field." From the opinions expressed on the floor, following Prof. Baity's presentation, it appears that there is a strong sentiment towards a Joint Council of Sanitary Engineers acting for the benefit of the sanitary engineering profession in all the various professional organizations.

Program

H. G. Baity
Prof. San. Engr.
Univ. of N. Car.
Chapel Hill, N. C.

A. E. Gorman
San. Engr.
At. Energy Comm.
Washington, D.C.

Nuclear Fission

"Problems of Nuclear Fission Operation and the Sanitary Engineer" was the title of the paper presented by Arthur E. Gorman, Sanitary Engineer, U. S. Atomic Energy Commission, Washington, D. C.

Mr. Gorman reviewed the unique aspects of the atomic energy industry, pointing out that Congress had given to the Atomic Energy Commission the exclusive authority to direct and control all research, production and development. This responsibility carried with it the education and training of scientists and other professional people, as well as a dissemination to the public of information concerning atomic energy.

In order that the listener might understand more about nuclear fission operations, Mr. Gorman reviewed the preparation of raw materials, discussed nuclear reactions and the characteristics of radioactivity. Because of the fact that radioactive substances have a decay curve, the sanitary engineer must take into consideration the time factor of decay. This is a new factor to be considered in sanitary engineering.

As to the disposal of atomic energy wastes, Mr. Gorman explained how water was used to cool a nuclear reactor or how air might be used for the same purpose. He then spoke of the effects of these radioactive wastes on both water and air and what must be undertaken to combat their effects.

Where liquid wastes are being disposed of this problem is being met with research to ascertain the best method of disposal. The U. S. Geological Survey is cooperating with the A.E.C. on a research program to appraise the effectiveness of underground disposal methods at various areas.

The problem of disposal of gaseous wastes has been attacked by a group under the chairmanship of Dr. Abel Wolman, Professor of Sanitary Engineering, Johns Hopkins University. At the same time solid wastes, which are recoverable, are being reclaimed, and equipment which has become contaminated is cleaned with acids and detergents, or, when too contaminated to use with safety, is stored in a restricted area, or is buried with adequate cover for shielding.

Research in a variety of sanitary engineering aspects of radiation and waste disposal to waterways and sewage systems is being carried on by the commission in cooperation with public health service at Oak Ridge and Los Alamos, and under contract with the Sanitary Engineering Departments at Johns Hopkins and New York Universities.

To approach the waste disposal problems involved, the sanitary engineer must learn a new limit of contamination. This is the microcurie which is a total of 37,000 disintegrations per second.

Mr. Gorman mentioned that the meeting was to be held in Washington (January 24-25), where about 35 key representatives of the American Water Works Assn. and Federation of Sewage Works Assn., Conference of State Sanitary Engineers, and Conference of Municipal Sanitary Engineers, would meet with representatives of the Atomic Energy Commission to learn more about this subject.

Water Supply Engineering

The "Bi-ennial Report of the Committee on Water Supply Engineering" was presented by the chairman of the committee, Thomas H. Wiggin, Cons. Engr., New York City.

Mr. Wiggin reviewed the two years, 1947 and 1948, and pointed out that despite the scarcity of material, slow deliveries, high and rising prices, there was an effort to correct deficiencies in water supply which accumulated during the war and which were accentuated by the post-war increases in demand.

The committee report covered such matters as important water works construction in various parts of the United States. This part of the report covered some 26 locations in various parts of the country. Also discussed were notable floods which had occurred in the two-year period, and drought conditions, as well as ground water conditions, including salt water encroachment, water level lowering, and ground water recovery. Conservation of ground water used in air cooling, and special methods of exploring for ground water were also discussed.

Program

T. H. Wiggin
Cons. Engr.
New York, N. Y.

L. L. Hedgepeth
Amer. Cyanamid Corp.
Bound Brook, N.J.

Of particular interest to water supply agencies, as well as stream pollution, was the section on the abatement of stream pollution, a section of the report which covered Public Law 845, and its provisions; also reviewed were the new Ohio River Compact, the New England Interstate Pollution Control Compacts and the efforts of New York State to develop a stream pollution control law.

Another section of the report dealt with pipe materials, including protection of cast iron pipe, lining pipe in place with cement mortar, cathodic protection for exterior pipe lines, prestressed concrete pipes, small diameter prestressed concrete pipes, sulphur-sand joint compounds, and quick operating valves.

The report by Mr. Wiggin's committee also covered centrifugal pumps, water purification and prevention of corrosion, the mechanical filtration plant at Chicago, and such miscellaneous items as upward flow versus conventional type of pretreatment, silica removal by iron

shavings, rendering water non-corrosive, micro-screening of water, nitrates in potable water, and cathodic protection of steel tanks.

The report by the committee concluded with the discussion of the evaluation of public utilities and water rates.

New York's Delaware Water Supply

"THE DELAWARE WATER SUPPLY SYSTEM OF THE CITY OF NEW YORK" was presented by Roger W. Armstrong, Chairman of the Board of Engineering Consultants, Bureau of Water Supply, City of New York.

Mr. Armstrong said that barring unforeseen circumstances the Delaware Water Supply System, which had been proposed in 1927 for completion in 1939, will be finished about 1954. The original estimate was $273,000,000 and the present estimated cost is $440,000,000. Construction has been delayed for several reasons—legal and financial obstacles, the war, and shortage of the supply of materials.

The Delaware System, which is now under construction, will deliver an additional 540 mgd. to New York City. The system includes three reservoirs and a pressure tunnel which runs 85 miles to the city. There are three dams, all rolled earth structures. The tunnel to New York will vary in depth from 300 to 2,500 feet below the original ground surface. It will increase in diameter as it approaches the city and reach a maximum of 19 ft. 6 in. In his discussion of the project, Mr. Armstrong explained what portions of the new supply would come from each of the tributaries of the Delaware River, these tributaries being the East Branch, the Never Sink River and Round Out Creek and tributary to the Hudson River.

While this new supply is under construction, the water consumption in New York City is reaching the maximum available in the present supply. Studies are now in progress to develop the Delaware Aqueduct as a temporary supply from some adjacent source to take care of the emergency expected between now and 1955.

An adequate water supply for New York City is a never ending problem. The Delaware system was proposed even before the completion of the Catskill System and even now, before the Delaware System is completed, studies are in progress for an additional supply beyond that available with the new supply.

Industrial Waste

Speaking on "INDUSTRY AND ITS WASTE TREATMENT," L. L. Hedgepeth, formerly Exec. Secy., Virginia Water Control Board, Richmond, Va., and now Cons. Engr., American Cyanamid Corp., Bound Brook, N.J.,

Program

H. T. Critchlow
Chairman
Water Pol. Comm.
Trenton, N.J.

Rolf Eliassen
Prof. San. Engr.
New York Univ.
New York City

cited examples of cooperation between the State of Virginia and industries. Such cooperation is necessary to the solving of industrial waste problems. There is yet much work to be done to abate present pollution and to prevent future pollution.

Among the necessary tools to attack the problems are improved technical knowledge of process control and increased knowledge of human relations. Some problems may be solved with the proper technical approach now available; others must await new information. One of the most profitable methods of attack according to Mr. Hedgepeth is to employ practicability in the interpretation of the law and of technical data. By keeping discussions on a practical level, development of divergent and incompatible views is avoided, along with the avoidance of wishful thinking and misunderstanding between industry and government.

Zoning of Water Resources

"CONTROL OF WATER RESOURCES BY ZONING" is the only sound approach to the problem of dwindling water supply resources, according to Howard T. Critchlow, Chief Engr., Div. of Water Policy and Supply, New Jersey Dept. of Conservation, Trenton, N.J.

Mr. Critchlow reviewed the statutes of the State of New Jersey and pointed out that such statutes fall within the police power and where fairly adopted have been upheld in the courts.

In New Jersey, the commission to regulate surface waters was established in 1907, and control of ground water for potable supplies followed. It was not until 1947, however, that the legislature adopted an act to give control over diversion of subsurface and percolating waters in the state for domestic, industrial and other uses. The law now, therefore, gives control over private ground water supplies. Under this legislation, the Commission has established two protected areas and is proposing a third.

Refuse Collection

The last paper on the technical sessions of the Division was a report of the "Committee on Refuse Collection and Disposal." The report was made by the chairman of the committee, Dr. Rolf Eliassen, Prof. Sanitary Engineering, New York University, New York City. Inasmuch as this report was not related to water supply or sewage disposal, its contents will not be reviewed here.

Films and Filmstrips Available

The Public Health Service has published a classified list of films and filmstrip productions released by the Federal Security Agency through the Communicable Disease Center.

These films or filmstrips deal with such items as Anatomy, Entomology, Hospitals, Insect Vector Control, Laboratory Techniques, Parasitology, Sanitation and Sanitary Engineering, Tropical Diseases, Veterinary Medicine, etc.

Included in the sanitation and sanitary engineering pictures are those on garbage and refuse disposal, insect control, food supply and handling, rodent control, sewage treatment, and water supply and treatment.

These films are available on a 30-day free loan to schools of sanitary engineering upon request, or to other interested persons and agencies. To obtain the classified list of films or to obtain the films themselves, address Merle Wimmer, Chief, Utilization Branch, Communicable Disease Center, 605 Volunteer Bldg., Public Health Service, Atlanta 3, Ga.

Sewer Pipe Production Up Markedly

The U. S. Census Bureau records shipments of clay sewer pipe and fittings in 1947 to a value of $47,900,000 in comparison to a figure of only $18,300,000 for shipments by the clay pipe industry in 1939.

A WORKABLE POLLUTION CONTROL PROGRAM FOR NEW YORK STATE*

by

ASSEMBLYMAN HAROLD C. OSTERTAG
CHAIR. N. Y. STATE JOINT LEGISLATIVE COMMITTEE ON INTERSTATE COOPERATION

FOR A legislator to address sanitary engineers on the desirability of abating and preventing stream pollution is like bringing coals to Newcastle! Yet, I have made bold to accept your kind invitation to address this joint session of three great technical societies, because you who are intimately connected with the design, the construction and the operation of pollution abatement works and public water supply systems are our staunchest allies in our efforts to clean up pollution in the 70,000 miles of streams, the 3½ million acres of inland lakes and the vast expanse of coastal waters, which represent the great natural water resources of New York State.

I am glad to discuss this health, conservation and sociological problem with a group of engineers, because it will become your responsibility to produce the technical solutions, in terms of municipal sewage treatment plants and industrial waste disposal works, when the state enacts a comprehensive long-range pollution control law.

Since the origin of our health and conservation laws dealing with pollution, many studies of the problem have been undertaken and many recommendations offered to prevent the progressive degradation of our waters. Yet, no undertaking of the past has ever been attacked—with the same spirit of determination—the same devotion to purpose and duty—the same teamwork—as that employed by the special committee on pollution abatement of our legislative committee on interstate cooperation during the past two and a half years.

In the New York legislature and this important legislative committee, we have dealt with scores of vital state and interstate problems. Yet, not one of these programs has been of greater social and economic benefit to the people of our state than the one under discussion.

Stream pollution is not peculiarly a New York State problem—it is a universal concomitant of our urban and industrial progress. Yet, New York's problem is of particular moment because we have the nation's greatest population concentrated in an area that stands 30th in size among the states, and it goes without saying that our industrial growth has been equally concentrated.

Municipalities and industries have used freely of our vast water resources—in many cases without adequate sewage and waste disposal facilities. It is not surprising, therefore, that our studies have disclosed that more than a billion gallons of untreated sewage and industrial wastes—probably much more—flow into New York's watercourses every day of the year. Every watershed in the state is contaminated in some degree, either by domestic or industrial wastes—and many of them by both.

These pollution conditions can be corrected. I do not mean that we must make drinking water out of our sewage and factory wastes. Nor can we convert all of our rivers and lakes into trout streams. It seems to me that we must set ourselves to the task of treating liquid wastes sufficiently to permit our waters to absorb these vast discharges which are the natural result of our great progress and growth, without impairment of the usefulness of these waters for other social purposes.

It would be remiss on my part not to pay credit to the 331 communities in New York State which now treat their sewage; to the many industries which provide treatment for their processing wastes; to more than 100 communities which have prepared or are preparing engineering plans for sewage treatment facilities; to the industries which are now studying their waste problems; and to the 68 state institutions which now provide for the treatment of their liquid discharges. Yet, I would be equally remiss if I did not point out that the efforts of these progressive municipalities, industries and institutions are, in great measure, being nullified by the inaction of others in permitting their wastes to go untreated.

New York State has not been unaware of the importance of the problem and the imperativeness of its solution. In the two and a half years since we embarked on the study of the state's water pollution problem, our committee has done much to point up the task ahead—and to start doing something about it. Here are some of the highlights of our planned program of study and action:

1. A completed study of the extent and nature of water pollution in the state, described in our two reports to the legislature.

2. Regional pollution abatement conferences conducted for the purpose of studying local problems and encouraging municipalities and industries to approach the solution of their waste disposal problems at an early date.

3. A study of the legal and administrative machinery now available for the control of pollution, together with the fiscal factors involved in the construction and operation of pollution abatement works.

4. Sponsored legislation calling for state aid to municipalities for the preparation of construction plans for sewers and sewage treatment works, as a means of accelerating the building of abatement facilities.

5. Recommendations for the early completion of the program of treating sewage for all state institutions, initiated nearly 20 years ago.

6. Preparation and distribution of a model local sanitation code, aimed at correcting local pollution caused by unsatisfactory methods of sewage and refuse disposal in structures not connected with public sewer systems or served by waste collection utilities.

7. The introduction for study purposes, during the 1948 session of the N. Y. legislature, of a water pollution control bill aimed at preventing all new water pollution and abating existing pollution on a long-range basis.

8. Hearings held in various sections of the state on the proposed pollution control bill with municipal and industrial groups participating.

9. Maintaining close touch with representatives of the federal government, interstate agencies and our neighboring states. This activity has been essential for the proper integration of intrastate and interstate development.

Now water pollution cannot be eliminated by any magic formula, nor can we pull clean and safe waters out of a hat!

Before we finish the job it will take patience and it will take plenty of money. Let us not expect to complete the job overnight. It will take years to undo the ravages of years.

*An address presented before the joint luncheon of the N. Y. S. S. W. A., the N. Y. Sect. A. W. W. A., and the San. Engr. Div. of A. S. C. E. on Jan. 21, 1949, in N. Y. City. Condensed for publication by permission.

Before we finish the job, it will take planning. Planning goes ahead of performance. A pollution abatement program must be planned to fit the needs of every body of water in the state.

Before we finish the job municipalities will need money—and the ability to expend these funds for sewage disposal works, within the constitutional limitations on bonded indebtedness and within the framework of sound fiscal practices. And industries will be required to expend large sums to finance their share of any pollution abatement program.

While we all recognize that pollution cannot be abated by the mere passage of a law, our committee's studies clearly indicate the serious need for better legal and administrative machinery to actuate a new and more energetic long-range approach to sewage and waste pollution control in New York State.

The fundamental shortcomings, defects and conflicting controls over pollution which are written into the state's health and conservation laws make clear the basic need for a sound, equitable and progressive governmental mechanism, which led to the proposed pollution control bill being offered by our committee to the legislature this year.

This proposed act would amend the present public health law, the code of criminal procedure, and the state finance law, in relation to providing for the control, prevention and abatement of pollution in the waters of the state.

1. It declares it to be the public policy of the state of New York to maintain reasonable standards of purity of its waters, consistent with public health, the propagation of fish and wildlife, and the industrial development of the state, and to that end require the use of known available and reasonable methods of treatment to prevent and control pollution.

2. It has as its purpose the safeguarding of these waters by preventing new pollution and abating pollution existing when this law is adopted.

3. It creats a water pollution control board within the department of health to administer and enforce the provisions of the act, and provides for the appointment of an executive secretary who shall be a duly qualified sanitary engineer fully trained and experienced in pollution abatement and public health.

4. It provides for the utilization of the technical personnel and skills of the health and conservation departments and for the use of other personnel necessary to the conduct of the work of the board.

5. It defines the powers, duties and authority of the board.

6. It requires the board, after proper study and public hearings, to establish water quality standards and classify the waters of the state in accordance with considerations of best usage in the interest of the public and with regard to recognized engineering and other scientific factors.

7. It recognizes that no single standard of purity is applicable to all waters or even all segments of the same waters; that water will vary in quality depending on the nature of the streams, the character of the area and the most sensible use to which the waters are to be put. It recognizes that the use of waters for the disposal of sewage and industrial wastes is one of the natural functions of life.

8. It prohibits discharges of wastes which pollute the waters in contravention of the standards of purity and classifications of waters, and prohibits the construction and operation of new, and extension and operation of existing disposal systems without approval and permit by the board.

9. It requires the discontinuance of existing discharges which are causing pollution, but provides that one year's notice must be given, except where the discharges are an actual or potential public health hazard.

10. It provides civil and criminal liabilities for violations of the act.

11. It grants the board power, in its discretion, to extend the time for a period of five years or more within which pollution must be abated if it is impossible or impractical to comply with regulations and standards because of financial inability to construct needed works, or when no adequate or practical method of treatment is known.

12. It authorizes the board to classify or reclassify waters only after hearings are held and proper studies of all considerations of best usage of the waters are made.

13. It preserves the rights of all by requiring hearings to be held in connection with and prior to any action by the board on matters relating to sewage or waste discharges denying, revoking or modifying a permit, or determining that a discharge constitutes pollution, etc.

14. It requires that rules and regulations of the board shall be published before becoming effective.

15. It grants hearings for all persons aggrieved.

16. It prohibits the imposition of civil and criminal liabilities for violations arising out of emergencies or catastrophes.

In short, it provides legal procedures with sufficient potency to achieve a progressive correction of pollution, and at the same time recognizes the fair rights of all persons, the need for sensible time allowances and the reasonable principles upon which democratic compliance with laws is founded.

The problem of pollution abatement is not one on which any of us can come up with the final answers. But it is a problem which must be dealt with. It is urgent, and it is complex. It will take continuing and unrelenting teamwork to deal with it, and the team must include the public (including industry), whose understanding and support are essential; lawmakers at both the local and state level to provide adequate and effective legal framework through which a program of pollution abatement can be undertaken and maintained; fiscal officers, to deal with the financial problems involved; and, above all—engineers and technicians, who can define the problem and develop the know-how to solve it. That is a large team to be involved in the accomplishment of an objective, and yet every member of it is essential. And what is more, the failure of any member may adversely affect, if indeed it does not nullify, the entire program.

Let us be quite clear on this: clean, safe waters are not just an esthetic whimsy in this day and age. They are an absolute necessity to health and a sound economy. We cannot continue to temporize in dealing with the problem with any illusory hope that some day somebody else will solve it for us. It is either everybody's job or nobody's job. Let us say here and now, as I have said many times before, that I believe pollution abatement is primarily the responsibility of those who use and defile the waters, whether they be individuals, industries or municipalities; and that until everyone comes to look upon waste treatment as an integral and basic cost of existence in a civilized society, the degradation of our waters will increase, with staggering liability to our health, welfare and our whole economy.

ALLEGHENY COUNTY COMPLETES PRELIMINARY PLANS FOR COLLECTION AND TREATMENT SYSTEM

To Cost 82 Millions with Interceptors 91 Miles Long

by

JAY DU VON
Planning and Research Officer
BUREAU OF COMMUNITY FACILITIES
FEDERAL WORKS AGENCY

ALLEGHENY County, Penna., with the financial assistance of the Federal Government, the State of Pennsylvania, and the City of Pittsburgh has this year completed preliminary plans for an $82,000,000 collection and treatment system for municipal and industrial wastes. The plans call for many unusual features, such as interceptors 91 miles long, built for the most part under the river bed, and a single treatment plant to cost more than $13,000,000.

Allegheny County is the heart of Pennsylvania's vast steel and mining industry, and includes within its borders not only the city of Pittsburgh, but also three third class cities, 74 boroughs and 22 first class and 29 second class townships. The county includes 745 square miles and has a population of almost 1,500,000 persons.

The discharge of untreated sewage and industrial wastes into the streams of the great industrial center of Allegheny County has given it an unenviable reputation as being one of the most backward metropolitan areas in America in the matter of the abatement of pollution. The foulest river conditions in America would occur at Pittsburgh if it were not for the masking effect of acid wastes and some regulation of flow. The Report of the Ohio River survey stated in 1943 that "the concentration of organic waste below Pittsburgh is larger than that below any other community on the Ohio River proper." The situation becomes even more serious when it is realized that 51 water distribution agencies in the area take their water from surface streams, wells near the surface streams or from cribs located on the bottom of the river.

Although various studies of abatement measures had been made in Allegheny County since 1910, it was not until 1945, under the vigorous state law of that year, that the Sanitary Water Board issued orders to 102 municipalities and 90 industries in Allegheny County to stop polluting the streams of the State and proceed with the preparation of plans and specifications for abatement measures.

NOTE: The accompanying article tells how one of the most critical problems of water pollution in the United States is moving toward solution through the community's vigorous leadership and through financial aid from the city, the state and the Federal Government. The same three-fold cooperation in all probability will take place when the construction of the Allegheny County system is financed.

I venture to predict that a pattern is emerging from this picture—a pattern in which the community, the state, the Federal Government, and industry all share the burden of providing these essential facilities. When funds are appropriated to implement the Water Pollution Control Act passed by the 80th Congress, the Federal Government will help through grants and low interest loans to finance both planning and construction. A bill was introduced in the last session of the Pennsylvania legislature to give state aid for pollution abatement; other states may follow.

It seems to me that when a state orders a community to stop pollution, it should consider giving financial aid on an equitable basis. Without such aid few of the smaller communities will be able to afford sewers and sewage treatment.—Henry J. Sullivan, Division Engineer, Division 2, Bureau of Community Facilities, Federal Works Agency.

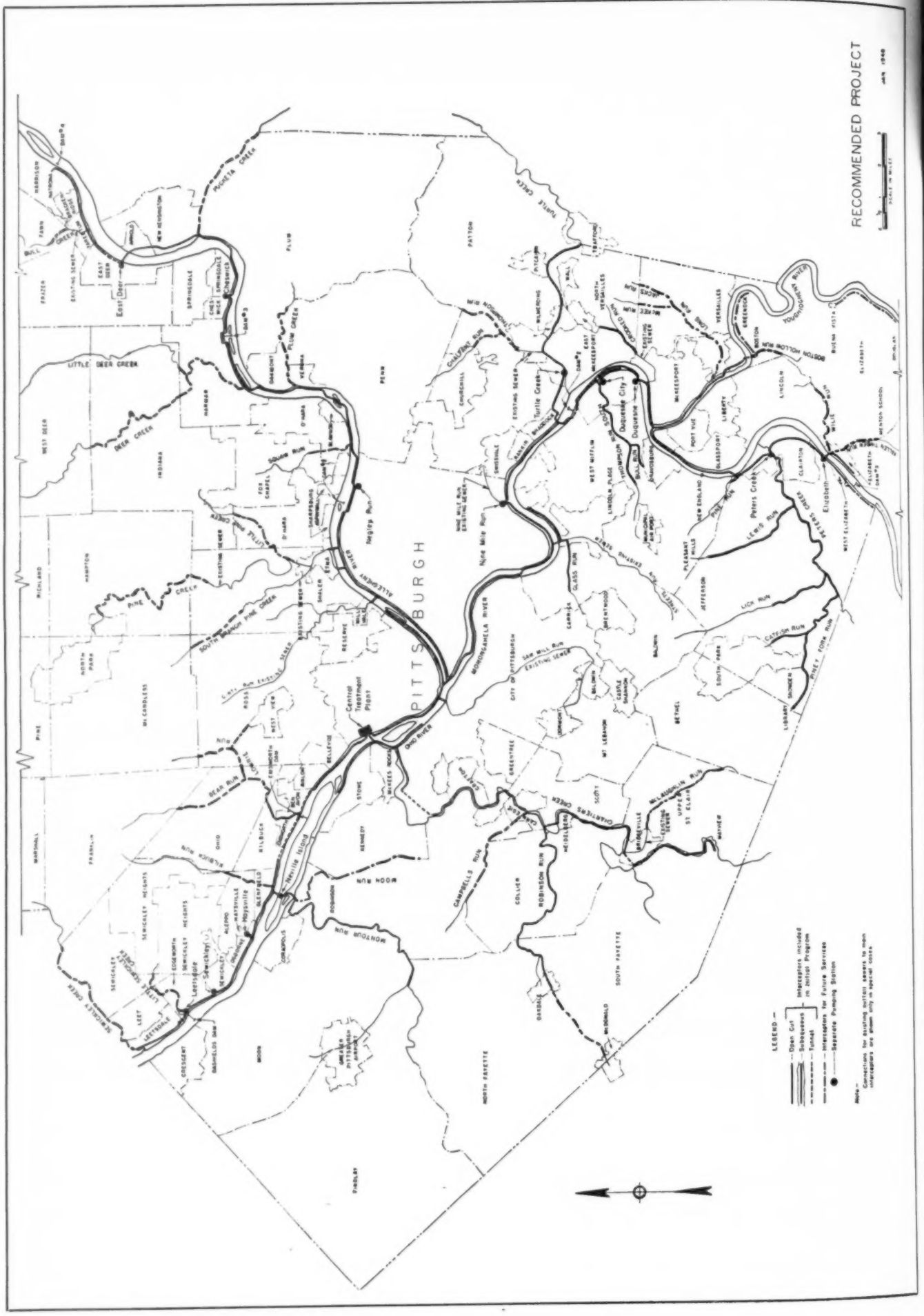
Allegheny County Commissioners then took the forthright step of creating the Allegheny County Sanitary Authority and appointing five prominent citizens including two engineers, two attorneys and a business man to its board. John F. Laboon, a former member of a firm of consulting sanitary engineers, was appointed for a term of five years and elected chairman. The other members are David Olbum, Secy.; William B. Rogers, Treas.; Cornelius D. Scully and Charles A. Finley. E. E. Bankson is Managing Engineer. The Authority was created under the Municipalities Authorities Act of 1945, after 74 municipalities passed formal resolutions that the solution of their individual problems could "best be accomplished on a county-wide basis in lieu of constructing and operating individual facilities."

Two Loans and a Grant

An administrative and engineering organization was built up with funds from three sources: Under the advance planning program of the Bureau of Community Facilities, F. W. A., the Authority borrowed $150,000, to be repaid without interest from the first bonds sold; an outright grant of $100,000 was made by the State; and a loan of $250,000 was received from the City of Pittsburgh. Municipalities to the number of 101 signed agreements to participate in the Authority program to the extent of the preliminary study and plans, at no cost to the individual communities.

More than 90 industries in the area subjected to the order of the Pennsylvania Sanitary Water Board were invited to joint the Authority under an agreement that they would pay a fee representing the nominal cost of determining the amounts and character of their industrial wastes and the conditions under which they could be made acceptable to the Authority for treatment. Thirty industries agreed to participate on this basis covering a total of $45,459.76 in fees.

The industries include metal manufacturers, brewers, chemical works, meat and food packers, foundries, dairies, distillers, etc. Other industries would have participated, but their wastes were unacceptable.


RECOMMENDED PROJECT
PITTSBURGH
Central Treatment Plant
ALLEGHENY RIVER
MONONGAHELA RIVER
OHIO RIVER
Turtle Creek
Plum Creek
Pine Creek
Deer Creek
Little Deer Creek
Girty's Run
Negley Run
Nine Mile Run
Saw Mill Run
Glass Run
Lick Run
Peters Creek
Lewis Run
Chartiers Creek
McLaughlin Run
Campbells Run
Robinson Run
Montour Run
Moon Run
Bear Run
Sewickley Creek
Thompson Run
Chalfant Run
Youghiogheny River
Duquesne City
Duquesne
Clairton
Elizabeth
Greenock
Boston
Versailles
Wilkinsburg
Edgewood
Swissvale
Braddock
Homestead
Munhall
Whitaker
Rankin
Dravosburg
Mifflin
Penn
Plum
Patton
Harrison
Fawn
Frazer
Indiana
Hampton
Richland
Pine
Franklin
Marshall
Ross
Aleppo
Kilbuck
Ohio
Kennedy
Stowe
Collier
Scott
Upper St. Clair
Baldwin
Bethel
Carroll
Jefferson
Pleasant Hills
Forward
North Fayette
South Fayette
Findlay
Crescent
Moon
Robinson
Oakdale
McDonald
Jefferson Memorial Hospital
Pittsburgh Airport
Neville Island
Sewickley Heights
Edgeworth
Leetsdale
Coraopolis
Glenfield
Haysville
Sewickley
Aleppo
Ben Avon
Ben Avon Heights
Emsworth
Bellevue
Avalon
West View
Ross
Etna
Shaler
Reserve
Millvale
Lawrenceville
Oakland
Squirrel Hill
Shadyside
Point Breeze
Regent Square
Wilkins
Edgewood
Swissvale
Wilmerding
North Versailles
East McKeesport
McKeesport
Port Vue
Glassport
Lincoln
Lincoln Place
West Mifflin
Dravosburg
Whitaker
Rankin
Braddock
Braddock Hills
Turtle Creek
Churchill
Wilkinsburg
Penn Hills
Verona
Oakmont
Harmar
Springdale
Springdale Boro
East Deer
New Kensington
Arnold
Harrison
Natrona
Pittsburgh
Mt. Lebanon
Dormont
Castle Shannon
Brentwood
Whitehall
Baldwin
Library
Shaler
Millvale
Sharpsburg
Fox Chapel
Aspinwall
Etna
Reserve
Bellevue
Avalon
Ben Avon
Ben Avon Heights
Emsworth
Edgeworth
Sewickley
Sewickley Heights
Leetsdale
Coraopolis
Glenfield
Haysville
Aleppo
Kilbuck
Ohio
Franklin
Marshall
Pine
North Park
McCandless
Richland
Hampton
Indiana
West Deer
Deer Creek
Harmar
Springdale
Springdale Boro
East Deer
New Kensington
Arnold
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Natrona
Fawn
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Plum
Penn
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Wilmerding
North Versailles
East McKeesport
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Port Vue
Glassport
Lincoln
Boston
Greenock
Youghiogheny River
Duquesne City
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Clairton
Elizabeth
Monessen
Buena Vista
Douglass
West Elizabeth
Lincoln Place
West Mifflin
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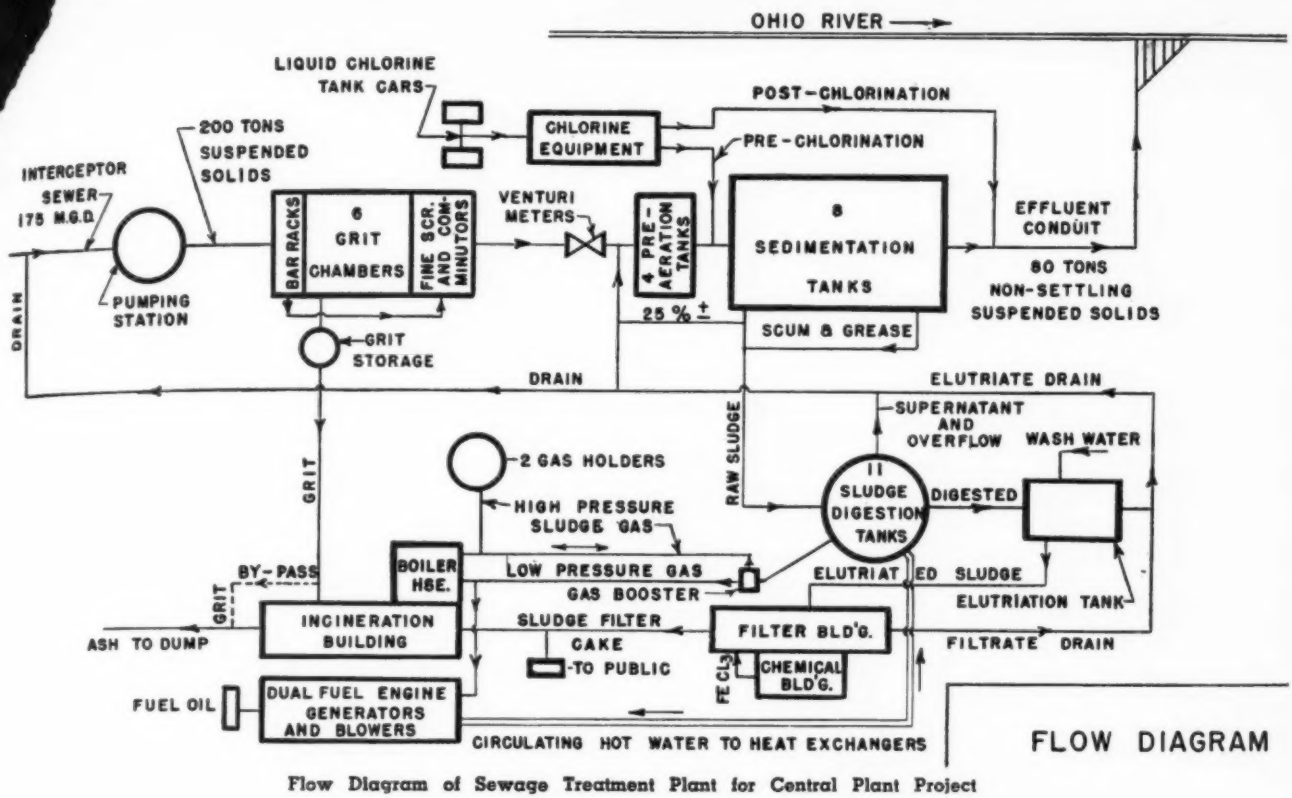
Wilmerding
North Versailles
East McKeesport
McKeesport
Port Vue
Glassport
Lincoln
Boston
Greenock
Youghiogheny River
Duquesne City
Duquesne
Clairton
Elizabeth
Monessen
Buena Vista
Douglass
West Elizabeth
LEGEND —
Open Cut
Subaqueous
Tunnel
Interceptors included in current Program
Interceptors for Future Services
Separate Pumping Station
Note —
Connections for existing outlets sewers to main interceptors are shown only in special cases.



Flow Diagram of Sewage Treatment Plant for Central Plant Project

Some of these may be able to participate later when pre-treatment for their wastes can be developed.

The participating industries include the Westinghouse Electric Corp., the Aluminum Co. of America, the Vanadium Corp., H. J. Heinz Co., the Pressed Steel Car Co., the Duquesne Brewing Co. and many others.

Organization

The Authority was organized into six departments: administrative, engineering, laboratory, surveys and construction, legal, and public relations. Mr. Laboon, as chairman of the board, is also executive officer and chief engineer of the technical staff. The organization was molded into an effective working unit and lost no time in attacking the problem.

The first phase of operations was to review earlier reports and bring them up to date. The Authority then proceeded to make geographical and population studies, as well as analyses of the quantity and character of sewage and industrial wastes to be treated. River surveys were conducted and the degree of treatment given careful study. Finally the types of interceptors and treatment plants were studied and cost estimates prepared. Rate studies and financing plans were developed and five alternate methods of financing were considered.

Final Recommendations

The final recommendations of the authority board, its engineering staff and the consulting engineers, Metcalf and Eddy, were published in the well written and illustrated printed report published in January, 1948. They can be summarized as follows:

1. To collect the municipal sewage and industrial waste of 101 municipalities by a 91-mile long main interceptor, constructed for the most part under the river bed and running to a single treatment plant on the Ohio River for primary treatment. The system is designed to provide for a population of 2,000,000 by the year 2,000.

2. The estimated cost, based on July 1947 price levels, will be $82,000,000, less an anticipated state grant and possible Federal assistance under the National Water Pollution Control Program administered by the U. S. Public Health Service and the Federal Works Agency. A revenue bond issue can be floated to provide funds for the undertaking.

3. The Authority can take over the sewage systems of the various municipalities for maintenance, repair, reconstruction, extension and construction of new sewers on the basis of adequate sewerage service charges in addition to uniform sewage service charges for collection and treatment.

4. A total annual revenue of $4,869,000 which includes provisions for debt service and all operating expenses will be sufficient to support the program in 1955 when the project should be completed.

5. The program can be financed by application of the following schedule of sewage service charges against individual sewage quantities as measured by water usage:

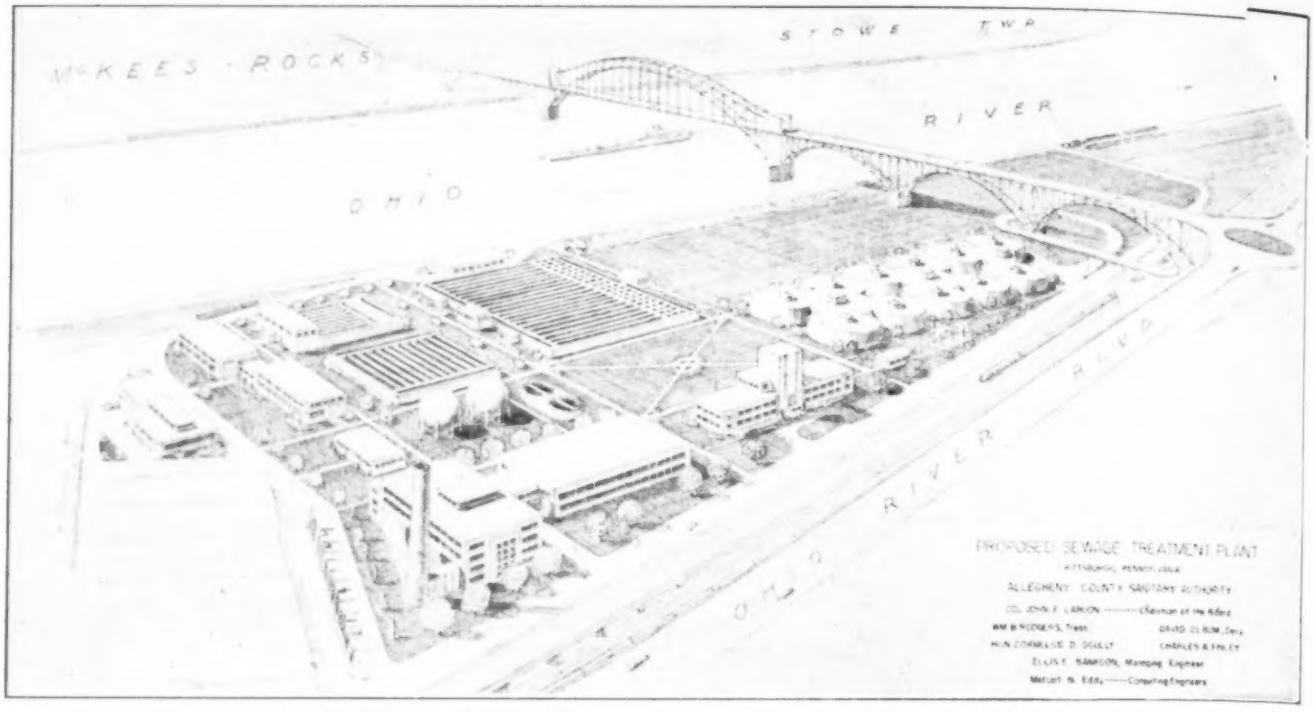
For the first 10,000 gal. or less per quarter, from one customer, at 18 cents per 1,000 gal.

For the next 1,000,000 gal. or less per quarter, from one customer, at 12 cents per 1,000 gal.

For the next 2,250,000 gal. or less per quarter, from one customer, at 9 cents per 1,000 gal.

For all over 3,350,000 gal. per quarter, from one customer, at 7 cents per 1,000 gal.

Provided, however, that no bill shall be rendered for less than 50 cents per month, or $1.50 a quarter, and further provided that a surcharge shall apply wherever solids content, the biochemical oxygen demand, or chlorine demand of the individual sewage is higher than the composite average of the sewage treatment plant influent. In cases where water bills are rendered on a flat rate basis, the individual sewage service charge will be based on 85 per cent of a water charge, using the City of Pittsburgh flat rate schedule for water service as the measure. Of the total annual burden it is estimated that commerce and industry will carry 40 per cent and householders 60 per cent.



Artist's Sketch of Proposed Sewage Treatment Plant for Central Plant Project

Following completion of the initial investigation and report, the Authority is now proceeding to execute firm agreements with participating municipalities. The third step, scheduled to begin in 1949, will be the development of contract plans and specifications for construction. It is hoped that construction can begin in 1952 for completion in 1955.

Thanks to the vigorous and aggressive work of the Authority "The Gateway to the West" will again send clean waters down the great Ohio to the Mississippi.

OHIO COMPACT COMMISSION HOLDS FIRST HEARING

The first hearing of the Ohio River Compact Commission was held on Feb. 16, to obtain data, information and evidence for use by the Commission in determining the degree of treatment to be given sewage and wastes discharged into the Cincinnati pool of the Ohio River. The hearing board consisted of three commissioners headed by Joseph L. Quinn, Vice-Chairman of the Commission. For the purposes of the hearing a report was presented by an Engineering Committee headed by Commissioner B. A. Poole, Tech. Secy., Indiana Stream Pollution Control Board. The report was drafted largely by the secretary of this committee, M. LeBosquet, Jr., Sr. San. Eng., U.S. Pub. Health Service, Cincinnati.

The requirements for this pool (22 miles between Dams 36 and 37) are higher than the minimum requirements set up in the Compact. For this pool, the report called for a "substantially complete removal of settleable solids and 65 per cent reduction of B.O.D." in organic wastes discharged into it. The Compact calls for a minimum of 45 per cent removal of solids and approximately 35 per cent removal of B.O.D., but higher standards can be promulgated where necessary.

In arriving at the standards for the Cincinnati pool, consideration was given to the desired objectives, namely a minimum of 4 ppm. of dissolved oxygen at the bottom of the oxygen sag curve at times of minimum flow in the river, taking into account beneficial effects of low flow regulation achieved through the use of flood control reservoirs, now built or projected.

With a reduction of organic load, a substantial reduction in bacterial content is to be expected. To achieve the objective it was estimated by the committee that a B.O.D. reduction of 40 per cent would be required every two years, 50 per cent every three years, and 55 per cent every 10 years. During one summer in every 20 years, however, 65 per cent reduction will not attain the desired objective. Sixty-five per cent treatment, however, appears to be the limit reasonably justified and that was the standard set by the committee report.

Edward J. Cleary, Exec. Dir. and Chief Engineer of the Ohio River Compact Commission, released the Engineering Committee report with the comment that inasmuch as no objections were raised to this standard at the public hearing, it would undoubtedly be adopted by the Commission at its April meeting.

Ill. Health Dept. Unique Calendar

For the second successive year the Division of Sanitary Engineering of the Illinois Health Dept., under the direction of C. W. Klassen, Chief San. Engr., has issued its "Over the Spillway" Water Works Calendar. Prepared and edited by LaVerne D. Hudson, Prin. San. Engr., this calendar not only gives the days of the month as any ordinary calendar, but also on particular days of the year it gives tips to water works operators: tips such as when to attend the operator's short course, when to bring the distribution map up to date, when to paint the plant, when to rejuvenate the chlorinators and dozens of other helpful hints to good operation.

The calendar also contains pictures of several well-known operators in the state, the pictures being shown on the birth date of the men. In addition, the calendar contains suggestions to read certain articles of importance, and helpful quotations from good articles that have appeared in the technical press.

SOMETHING NEW IN SEWAGE TREATMENT

by
JOE WILLIAMSON, JR.*
Consulting Engineer
DAYTONA BEACH, FLA.

THE new sewage treatment plant of Daytona Beach, Fla., scheduled to go into operation early in April, will be new in several respects—design, method of operation, process employed, and relative costs.

The unique treatment process, known as "The Daytona Beach Process," is an accelerated *high-rate* chemical precipitation process in which very low cost precipitants are utilized in conjunction with combination coagulation and up-flow clarification units.

The principal chemical coagulant utilized in this process is calcium carbonate. In Daytona Beach, large volumes of this material are obtained free of cost from the local (lime type) municipal water softening plant near by. This presently useless by-product sludge from the water plant contains several times the amount of calcium carbonate required by "The Daytona Beach Process," but the excess carbonate presents no problem and has considerable advantages. Pilot plant experiments indicated an overall BOD removal of 70 to 80 per cent with only one hour detention in the specially designed combination coagulation and sedimentation basin. Although results to be expected indicate twice the BOD reduction of conventional primary treatment, initial cost of the "Daytona Beach Process" plant is much less than a plant for primary treatment as ordinarily provided.

We have already had one of the special combination coagulation and sedimentation basins in preliminary operation. Final laboratory results are not yet available, but our visual observation of the effluent leads us to believe that plant scale results will be equal to those obtained in the pilot plant experiments.

Attractive Features

Pilot plant tests indicated that there might be great fertility value in the combined carbonate and sewage sludge removed in the process. It is apparent that the combined raw sludge de-waters very readily on vacuum filters. This fact has long been known in conventional chemical precipitation plants using commercial lime. Moreover, in addition to the valuable normal organic matter this process sludge contains calcium carbonate which is the active component of "agricultural lime," and many soils require both.

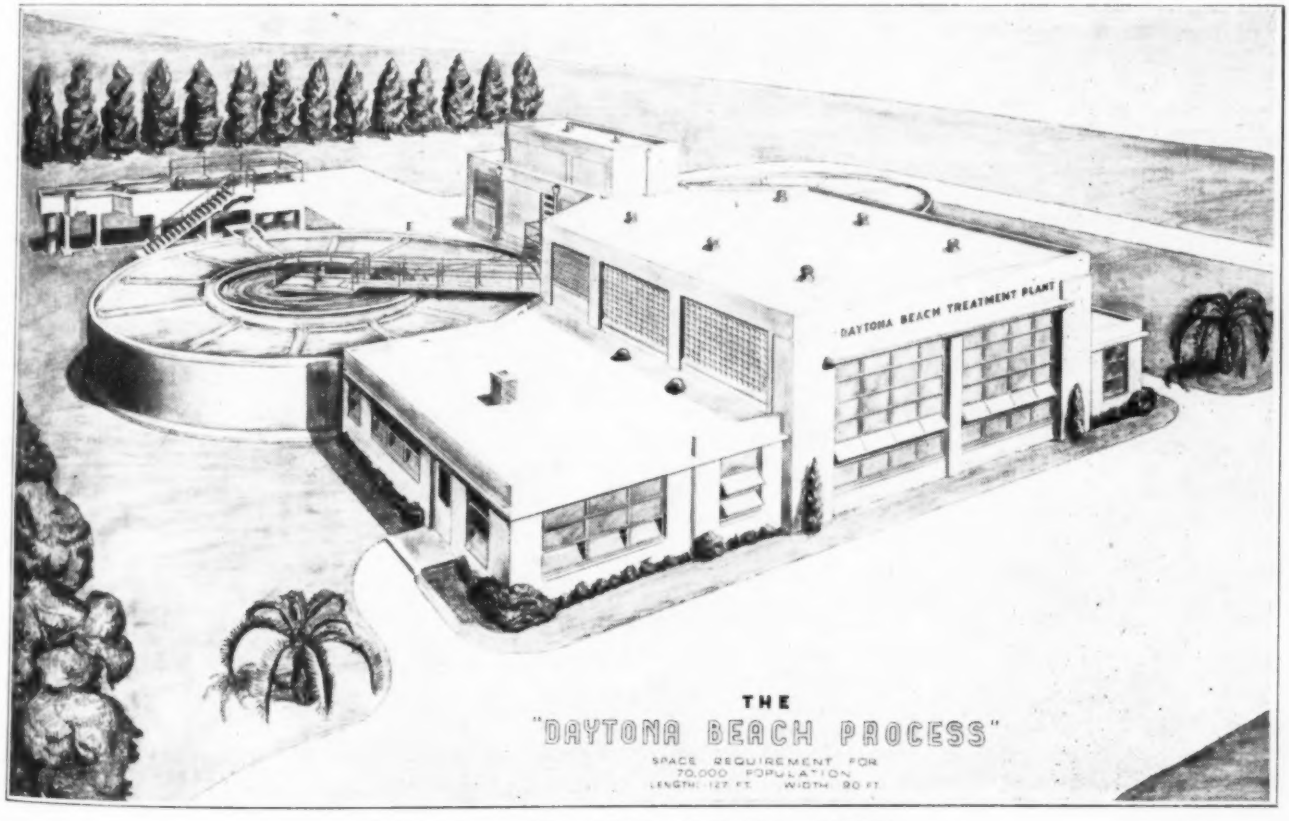
If this process is successful, considerable saving in initial treatment plant costs may not be the only important economic aspect of this process. The space requirements of this process are so small it is conceivable that such a plant can be constructed entirely underground in a park, under a street, in a commercial or residential district; in fact, anywhere a conventional large sewage pumping station could be constructed. This could possibly bring a new concept in design of sewage collection systems. Individual, strategically-located plants of this type conceivably could eliminate the high cost of conventional outfall and interceptor systems required for transportation of sewage to a single isolated plant site.

We are now considering the possibility of constructing "Daytona Beach Process" plants underground or in gas-tight buildings above ground in heavily built-up areas. Obviously, no final recommendations relative to future applications are justified until we have conclusive laboratory reports and plant scale results at the Daytona Beach plant.

Performance Bond Posted

Before the Florida State Board of Health would approve construction of this Daytona Beach plant, the State very correctly insisted on a manufacturer's surety bond being posted to guarantee specified BOD and suspended solids removal. Such a surety bond was posted by the manufacturer (Infilco, Chicago) supplying the special process equipment. This manufacturer had for some time been experimenting with calcium carbonate treatment of certain industrial wastes, and the full scale plant was designed and built only after an adequate study of the process through operation of a pilot plant on Daytona Beach sewage.

*Vice-president, Russell & Axon, Engrs., St. Louis, Mo., and Daytona Beach, Fla.



Artist's Drawing of the Daytona Beach Treatment Plant.

The Editor's Comments

The Texas Short School

Elsewhere in this issue is an account of the 31st Annual Texas Water and Sewage Works Association Short School. We consider this report markedly inadequate and sincerely regret our inability to print a report which would do full justice to the now famed Texas Short Schools, which are the largest and most productive of their kind, not only in America but in the world. A child of V. M. Ehlers, veteran State Sanitary Engineer of Texas, who has served as its secretary during the entire 31 years, the Texas Short School is held during the fore part of February each year at Texas A. & M. College.

Originally a three-day affair, the school has now grown to one of five very full days and nights. During these five days four separate sessions are kept going simultaneously —a senior and a junior session in the Water Supply Section and a senior and junior session in the Sewerage Section. The senior sessions in water and sewerage provide courses for those seeking the Grade "A" or "B" Operator's License. The junior sessions in water and sewerage provide courses for the "freshmen" seeking the Grade "C" License. At the close of the school a full day is devoted to licensing examinations, and the only complaint heard of the 31st Short School was that of a group of enrollees who decried the fact that it was not possible for them to take in more than one of the four parallel sessions at a time. In other words, like the writer, these enrollees felt that they were missing much by not being able to sit in on more of the programmed lectures and demonstrations.

The evenings were given over to General Sessions which provided programs of interest to all grades of water and sewage works operators. As a matter of fact, this Texas Water and Sewage Works Assn. deserves the classification "big-business" when it is realized that the membership in the 18 approved Regional Associations, which make up the State Association, now number more than 650 paid memberships—with a potential of well above 1000 members.

It was the privilege of this writer, as president of the Am. Water Works Assn., to address the first evening General Session and the Annual Luncheon Session, sponsored by the Texas Division of the Southwest Section of A.W.W.A., and to present special awards during the Banquet Session to the member association boasting the highest per cent of fully "Approved Water Supplies" (not easy to get in Texas) and the member association with the highest per cent of licensed operators in its respective area. These appearances gave opportunity to make a comparison of size and productivity of the Texas Short School of 1926 (the first attended by the writer) and that of the 1949 School. In 1926 the value and accomplishments of the Texas Short Schools was amply evident in observations made personally during visits to a number of Texas plants and through conversation with operators boasting Short School Attendance Certificates. At that time the Schools were devoted wholly to water supply. Certification of operators was not mandatory, and the attendance at these schools numbered not more than 60. Compare this with the 1949 School with its registration of almost 450, in spite of the untoward weather in Texas immediately preceding the School. We wonder if pioneering founder Ehlers envisioned any such spectacular growth for his infant of 31 years ago.

What About Fluoridation?

The lead article in this issue describes the most spectacular method yet employed for the enrichment of public water supply with the fluoride ion. The novel "Madison Method" makes use of the none too kindly concentrated hydrofluoric acid with which familiarity is not likely to breed contempt.

What the future policy of the American Water Works Ass'n. is to be in respect to water fluoridation has been giving A.W.W.A. officials something to think about. A special committee has been named to study recent developments, consider future possibilities, and report to the Board in June its recommendations of what the A.W.W.A. "fluoridation policy" should be.

In taking an attitude, one way or the other, toward fluoride treatment of public water supply, there are several phases to be considered, and no hasty decisions or hard and fast policy should be considered. Apparently, the observations over the past two or more years at various locations point to a value from fluoridation of water supply. The results may not be spectacular but are of sufficient magnitude to justify continuation of the treatment. Almost without exception the dental profession appears to be for the treatment. From all that can be learned there have been no unfavorable or damaging results from fluoridation of water supply.

Considering the history of fluoridation to date, and considering the fact that one must realize that if the process proves worthy of adoption sometime hence, a community denied fluoridation during any period of "watchful waiting" will have lost the value of the treatment for such period. Neither is it pleasant to contemplate that such loss in tooth protection amongst the youngsters can *not* be made up through subsequent water treatment.

Whenever there develops a public demand for fluoride treatment, backed by local medical and dental opinion favoring the "experiment," it is our opinion that water utility management can ill afford to longer stand on the "watchful-waiting policy" or to object on the grounds of added expense to the utility.

The first will constitute bad public relations and the second objection should easily be resolved through a special appropriation or a rate increase which a public sufficiently desirous of the protective treatment will gladly accept.

The following possibilities should not be overlooked. First, should fluoridation be considered as a possible means of glamorizing water supply, thereby focussing public attention on water supply as no longer just the commonplace service which it has been taken to be much too long? Second, is it perhaps a means of softening the much needed rate increases at numerous places?

These two considerations are well worth more thought.

L. H. Enslow

YOU NEED BOTH HALVES OF THE SCISSOR

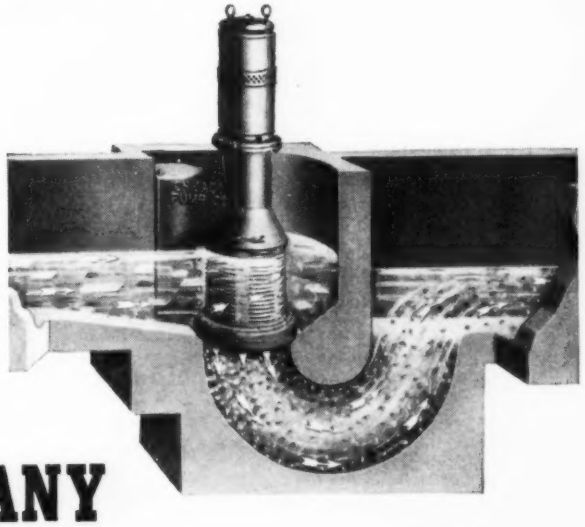
In the CHICAGO Comminutor the cutters and shear bars cut and chop; the channel feeds and holds.

The combination of channel and rotating drum makes the CHICAGO Comminutor the only effective method for cutting and screening sewage solids in the stream.

Engineering details of exclusive CHICAGO Channel Designs for any sewage flow are available to engineers on request.

Over 2000 successful installations prove "You Need Both Halves Of The Scissor."

The CHICAGO Comminutor is always placed in an exclusively designed feeder channel. The hydraulic characteristics are such that accumulating solids cannot clog the drum slots; nor can rope-like material jam the drum. Comminution is rapid and positive. Sub-surface screening is continuous and automatic.



Cross section of a CHICAGO Comminutor channel illustrates a typical design of controlled discharge channel. Sheared small particles must pass through a maximum drum slot width of 3/8 in. Comminuted matter completely settles out in the primary tanks.

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SEWAGE EQUIPMENT DIVISION

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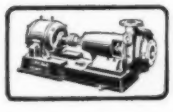
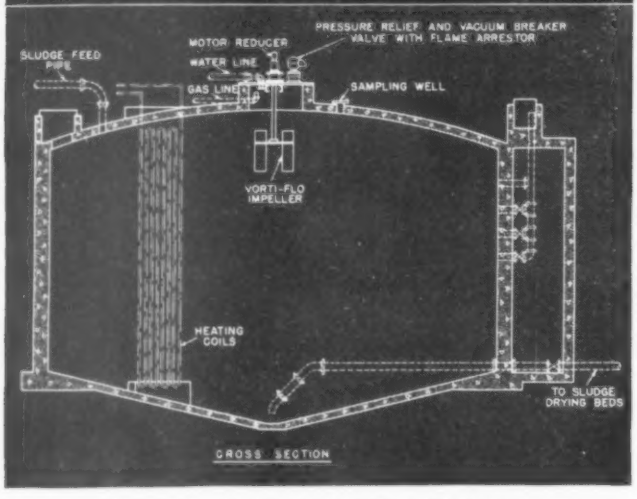


Flush Kleen, Scru-Peller, Plunger. Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers, Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

GET BETTER DIGESTION BETTER GAS GENERATION!



Cross sectional elevation of Infilco's VC Digester

WITH INFILCO'S VC DIGESTER

ELIMINATE the difficulties resulting from excessive scum formation. Get all the benefits of proper mixing, circulation and temperature control. The Vorti-Flo impeller in Infilco's VC Digester sets up a *controlled disturbance* in the upper part of the tank to prevent excessive scum formation. It also provides the agitation and mixing necessary for optimum digestion. Call or write your nearest Infilco Field Engineer or Chicago Headquarters for complete information.

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SALES OFFICES IN TWENTY SIX PRINCIPAL CITIES

WORLD'S LEADING MANUFACTURERS OF WATER CONDITIONING AND WASTE TREATING EQUIPMENT

MEETINGS SCHEDULED

APR. 11-13—LITTLE ROCK, ARKANSAS
Arkansas Water & Sewage Conference. Sec'y, Dr. Harrison Hale, Univ. of Arkansas, Fayetteville, Ark.

APR. 20-22—INDIANAPOLIS, IND. (Lincoln Hotel)
Indiana Section A.W.W.A. Sec'y-Treas., C. H. Bechert, Indiana Dept. of Conservation, State Library Bldg., Indianapolis, Ind.

APR. 21—BOSTON, MASS. (Statler Hotel)
New England Water Works Assn. Sec'y., Jos. C. Knox, 204 Tremont Bldg., Boston 8, Mass.

APR. 21-22—HUTCHINSON, KANSAS (Bisonti Hotel)
Kansas Section A.W.W.A. Sec'y-Treas., M. C. Hagar, Supt. Water Department, City Hall, Lawrence, Kansas.

(and)

Kansas Section, Federation Sewage Works Assn. Sec'y, Dwight F. Metzler, Room 2, Marvis Hall, Lawrence, Kansas.

APR. 21-22—LINCOLN, NEB. (Cornhusker Hotel)
Nebraska Section A.W.W.A. Sec'y, John W. Cramer, 922 Trust Bldg., Lincoln 8, Neb.

APR. 24-27—QUEBEC CITY, QUEBEC, CANADA (Chateau Frontenac)
Canadian Section A.W.W.A. Sec'y, Dr. A. E. Berry, Ontario Department of Health, Parliament Bldgs., Toronto, Ontario, Can.

APR. 28-29—ELMIRA, N. Y. (Mark Twain Hotel)
New York Section A.W.W.A. Sec'y-Treas., R. K. Blanchard, 50 West 50th St., New York, N.Y.

APR. 28-29—HAGERSTOWN, MD. (Alexander Hotel)
Maryland-Delaware Water & Sewerage Association. Sec'y-Treas., E. Virginia Gipe, 2411 N. Charles St., Baltimore, Md.

APR. 29-30—BAKERSFIELD, CALIF. (Hotel not selected)
California Section A.W.W.A. Sec'y, H. C. Medbery, San Francisco Water Department, Millbrae, Calif.

MAY 11—BELLINGHAM, WASH. (Bellingham Hotel)
Pacific-Northwest Sewage Works Association. Sec'y-Treas., W. P. Hughes, City Hall, Lewiston, Idaho.

MAY 12-14—BELLINGHAM, WASH. (Bellingham Hotel)
Pacific-Northwest Section A.W.W.A. Sec'y-Treas., Prof. Fred Merryfield, Oregon State College, Corvallis, Ore.

MAY 25—BRISTOL, CONN.
New England Sewage Works Association. Sec'y, Walter E. Merrill, State Dept. of Health, State House, Boston, Mass.

MAY 30-JUNE 3, 1949—CHICAGO, ILL. (Stevens Hotel)
American Water Works Association Annual Conference. Exec.-Sec'y, Harry E. Jordan, 500 Fifth Avenue, New York 18, N.Y. (All reservations will be cleared through the A.W.W.A. office.)

JUNE 5-11—GAINESVILLE, FLA. (University of Florida)
Florida Short Course & Conference for Water & Sewage Plant Operators. Chairman, David B. Lee, Bureau of San. Eng., State Board of Health, Jacksonville, Fla.

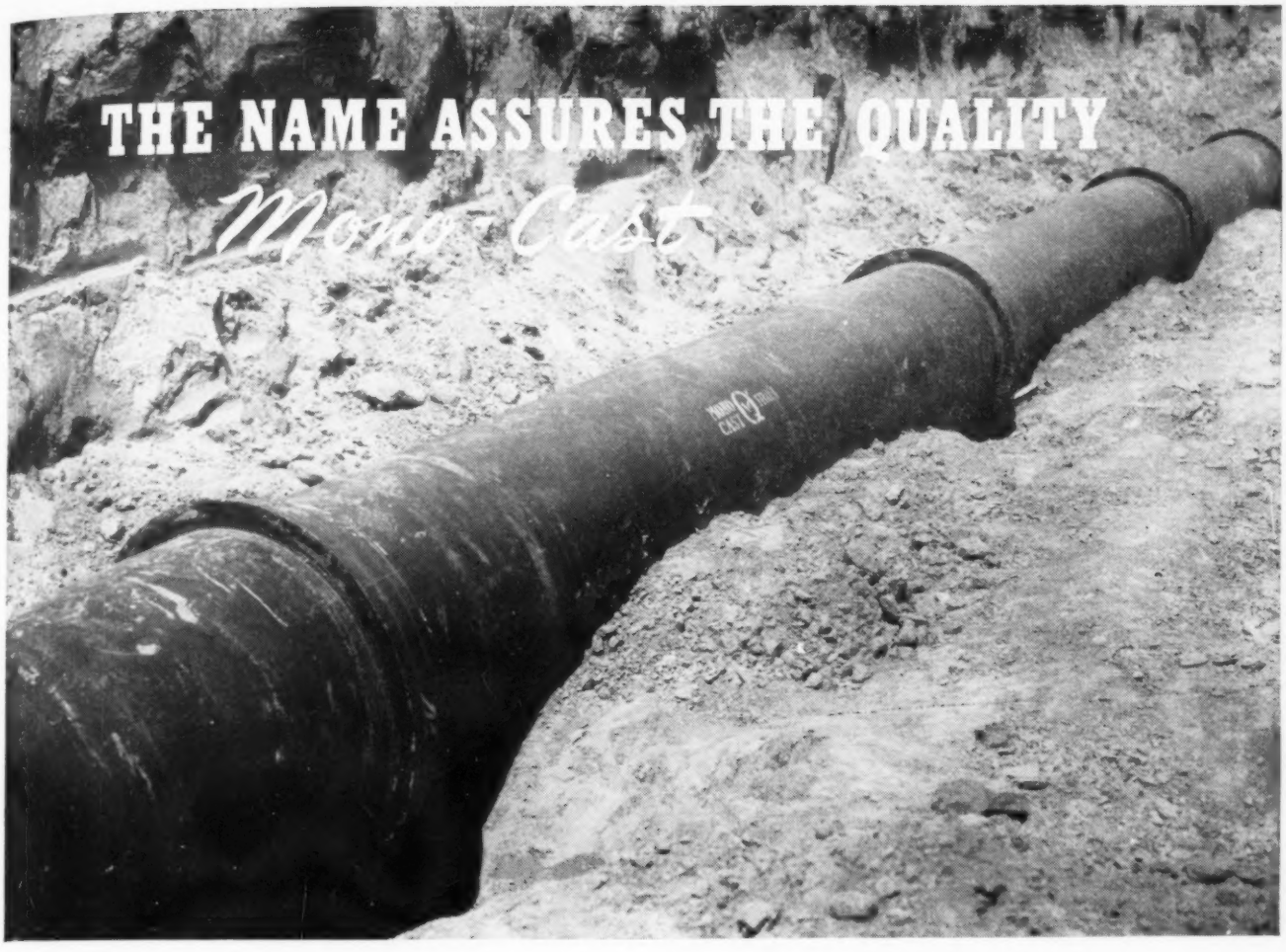
JUNE 9-11—TUSCALOOSA, ALA. (University of Alabama)
Alabama Water & Sewage Association & Short School. Sec'y-Treas., Prof. G. H. Dunstan, Univ. of Alabama, Tuscaloosa, Ala.

AUG. 22-24—STATE COLLEGE, PENNA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Association. Sec'y, I. M. Glace, 1001 North Front Street, Harrisburg, Pa.

AUG. 24-26—STATE COLLEGE, PENNA. (Nittany Lion Inn)
Pennsylvania Sewage & Industrial Wastes Association. Sec'y-Treas., Bernard S. Bush, Kirby Health Center, Wilkes-Barre, Pa.

SEPT. 8-9—MINNEAPOLIS, MINN. (Nicollet Hotel)
Minnesota Section A.W.W.A. Sec'y, R. M. Finch, 518 Metropolitan Life Bldg., Minneapolis, Minn.

SEPT. 13-16—DIXVILLE NOTCH, N.H. (The Balsams)
New England Water Works Association. Sec'y, Joseph C. Knox, 204 Tremont Bldg., Boston 8, Mass.



"Mono-Cast" is the trade name for Acipco pipe made by the centrifugal process. Manufactured under rigid specifications in diameters 3″ through 48″, it is corrosion resistant, will stand the impact of heavy loads and gives complete job satisfaction. It can be supplied with joints for conveying water, gas, oil, sewage and other liquids. These joints and a full line of standard accessory fittings make it easy to install under varying service and laying conditions.

Being cast iron, Mono-Cast pipe enjoys an enviable reputation won by outstanding performance. It retains the high regard of engineers year after year, in city after city, because of its long life and trouble-free qualities. Whatever your piping problem, refer it to Acipco and rest assured of conscientious assistance from an organization backed by 44 years of experience in producing highest quality cast iron pipe and fittings.

Write for literature, stating the kind of joint in which you are interested. Address the Acipco office nearest you.

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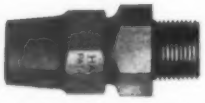
HAYS CORPORATION and CURB STOPS

For Trouble-Free Water Service



CATALOG No. 5605

Hays Coupling for copper to male iron pipe connection.

CATALOG No. 5040

Hays Curb Stop for copper inlet to female iron pipe outlet.

CATALOG No. 5016

Hays Curb Stop with lockwing for iron pipe A.W.W.A. standard thread.

HAYS corporation and curb stops are easy to install and are interchangeable with the products of any other manufacturers. They are good for many long years of trouble-free service. They are made of the best 85-5-5-5 bronze and plugs are precision ground for perfect fit. They are hydrostatically tested at 200 pounds or more and specially lubricated for permanent easy turning. HAYS corporation stops can be installed with any standard tapping machine equipment.

The HAYS reputation for quality is the heritage of 80 years' insistence on honest craftsmanship and fair dealing. The Hays Manufacturing Company is one of the largest in the field and its name is a synonym for the best everywhere. Write for the new HAYS catalog of water works products for every purpose.

CATALOG No. 5200

Hays Corporation Stop with inlet A.W.W.A. standard thread.

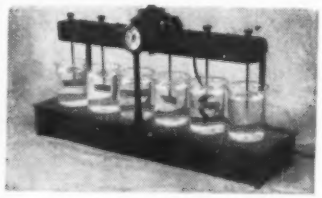
HAYS COPPER · BRASS · LEAD · IRON
WATER WORKS PRODUCTS
HAYS MANUFACTURING CO., ERIE, PA.

ANTHRAFILT
Trade Mark Reg. U. S. Patent Office
A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Building
Wilkes-Barre, Pa.

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Engineers and Sales Agents



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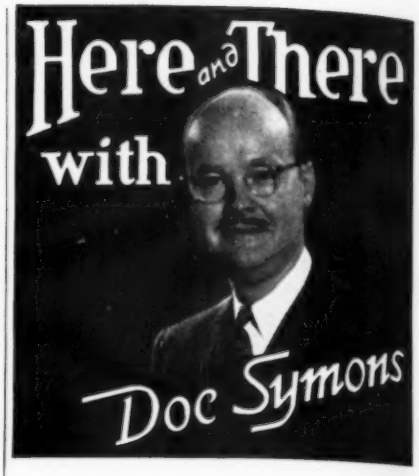
LABORATORY MIXER

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. Richmond, Va.



H.T.M.A.—And since you seemed to enjoy reading my mail last month, I thought you might like to read some more. So-o-o-o without further ado, here are a few letters I've received in the past few months.

* * *

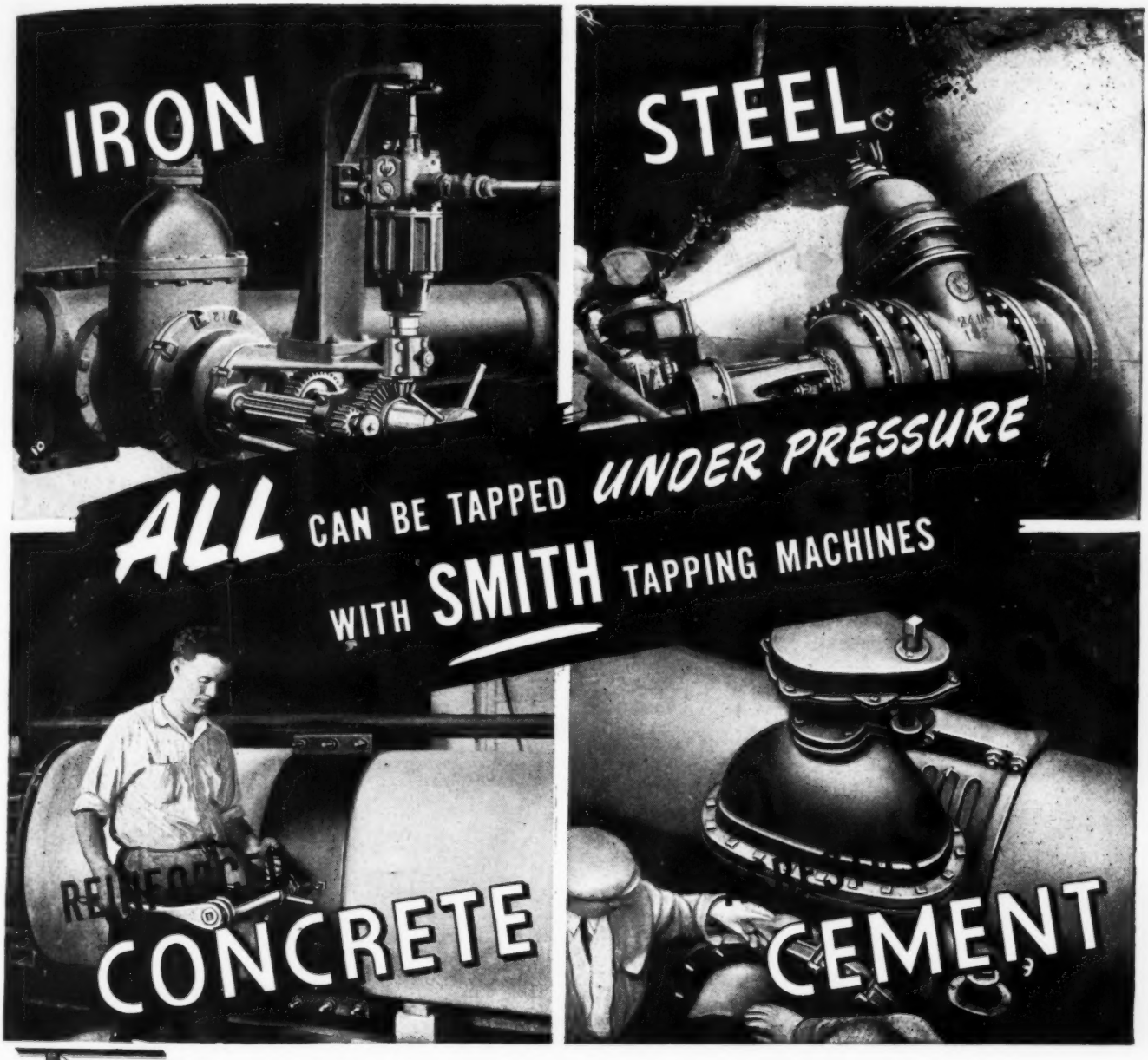
Wish I knew who sent in the story about using a ferret to pull a line through a partially clogged sewer. Seems he used to catch a rat, put it into a sewer followed by a ferret with a fish line attached to its tail—and presto, he had a line through the sewer. Whoever my correspondent was, he was reminded of his trick when he read in the *Chicago Sun-Times* where an electrical workers union in Auckland N.Z., had sued a firm for unfair practices; namely, using a ferret to pull 600 ft. of wire through a conduit, lured, in this case, by the scent of a rabbit.

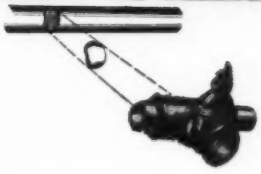
* * *

A long, long time ago, in the April, 1947, (yes '47) issue I ended the column with a list of outstanding men in this field and certain of their traits which I wish I had. Came a letter from Charles P. Hoover, that grand guy from Columbus, Ohio, who wrote, "So the author thinks he might have done a better architectural job on himself than his father and mother did. You may tell the world, I'm for your Ma and Pa.—Charlie." Nicest compliment I *ever* had!

* * *

When A. J. Krell set himself up in business in Dallas, Tex., as a manufacturers' agent he wrote me enclosing an item from the *Texas Oil Journal*. The item concerned the story of a celebration in Wichita Falls, Tex., in honor of the opening of a new water supply. At the same time the city entered suit against a local map maker from McAllen, Tex., for labelling the north Texas city as having the "world's worst water." On his next map said maker promises to label the





With Smith tapping equipment you can make branch connections up to 42" in diameter under pressure to any type or size of pipe, without interrupting service, draining the line, or riling the water. These machines are used with SMITH tapping sleeves, hat flanges, and tapping valves. The entire operation is quick, simple and satisfactory.

Write for Further Information

11-B

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CHECK VALVES
FIRE HYDRANTS
INSERTING VALVES
TAPPING SLEEVES AND VALVES
WATER SERVICE BRASS GOODS

THE A. P. SMITH MFG. CO.
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PIPE CUTTING MACHINES
CORPORATION TAPPING MACHINES

new water supply as the "wine of life." When the new supply (a "good soft palatable water") was introduced, more than a thousand mayors, water superintendents, city officials and GI's who had been stationed at nearby Sheppard Field were invited to join the celebration of the new supply. *That's* public relations, with a capital P. R.

* * *

And last October, I ran a news item about Ted Rimbach, following which he wrote, "Dear Doc: Thanks for the plug, even though you did spell my name incorrectly."—I hope I get it right this time.—Ted enclosed with his note, "Ted Rimbach's Placator and Fist Fight Arrester," the directions for which read as follows—"At first sign of excessive exuberance hang PLACATOR around the neck of the offending guest by attached lanyard. In extreme cases, card should be affixed by person of athletic type. WARNING: Guarantee does not cover family parties. Not effective between husband and wife."—On the front side of the card which measures 7 x 3⅜ inches is this legend:

NOTICE

The language employed and the opinions and sentiments expressed by the wearer are inspired solely by the refreshments consumed, and any similarity to those of any actual person living or dead is purely coincidental.

I understand that extra units of this Placator are available on request and if you will fill in a Reader Service Card with the Key Number HT-4, I'll forward the request to Ted.

* * *

A goodly number of my readers sent in Reader Service Cards requesting the various and sundry "slogan cards" mentioned in the January column, and I forwarded same to Jim Potter, the Calgon man in Charlotte, N.C. So far, I've had no letter of thanks from him, but one of the requests included this note:

"Dear Doc:—Your innocent little remark, 'Why Be Difficult; With a Little More Effort You Can Be Impossible' (in your Mar., '48, issue) has resulted in the plastering of all the places of public business in San Diego with that slogan, with improved relations all along the line. So let's have some more. Roy E. Dodson, San Diego, Calif., Water Dept."

Thanks, Roy. You know it makes a columnist feel mighty good to have something he writes translated into good public relations.—(Yes-sir, thanks for your kind words.)—In this case, however, credit for an assist goes to "Siggie" Sigworth of Nuchar, from whom I got the slogan, and the above mentioned Jim Potter, from whom Sigworth got it, and the fellow Potter swiped it from, and I suspect, more importantly—Roy Dodson, who saw its possibilities and capitalized thereon.

* * *

Speaking of "Siggie" Sigworth, he's the boy who, when he read the report on the Purdue Industrial Waste Conference in our January issue, picked up his pen and wrote: "Dear Doc:—I note that in picking captions for the speakers on the Purdue program, you employed a rather cryptic style, with connotations that are not always flattering. For example, on page 25 under the picture of Prof. Robt. E. Stiemke of Penn State, you have the label 'Slaughterhouse,' and under the picture of Roy F. Weston, you have 'Oil,' and under the picture of B. A. Poole of Indiana's famed Stream Pollution Control Board, you have 'Cyanide,' which is certainly a subtle way of calling a man 'poison'. Of course, I'll grant the possibilities of the method. As for example, in the same issue in the report on the Federation meeting in Detroit, you could have

You can save money with
PITTCHLOR
water treatment

Here are just two of numerous conditions where Pittchlor will save you money:

1. Where less than 500,000 gallons of water are treated daily.
2. Where the available chlorine demand is not large.

Pittchlor does the same effective job as liquid chlorine—but saves on equipment investment required. Pittchlor is saving money for many water systems around the country.

A high-test calcium hypochlorite containing 70% available chlorine. Granular, free-flowing, non-caking. Packed in 5 lb. cans (9 per case), 3¾ lb. cans (12 per case) and 130 lb. drums.

Write for descriptive literature and any other specific information you want. Pittsburgh Plate Glass Company, Columbia Chemical Division, Fifth and Bellefield, Pittsburgh 13, Pa.

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CARTER CARTER

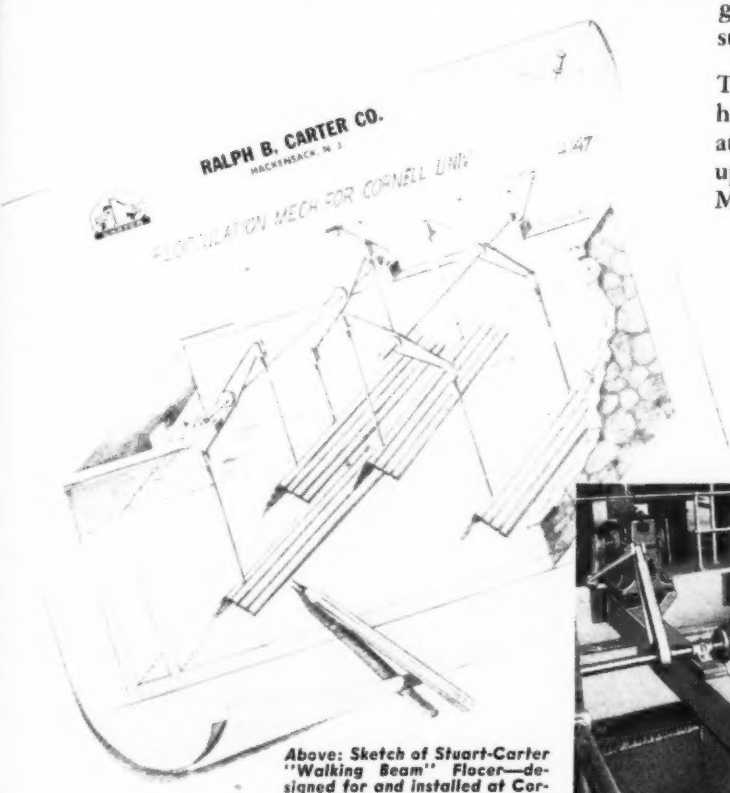
CORNELL UNIVERSITY'S WATER FILTER PLANT MEETS 61% INCREASED DEMAND

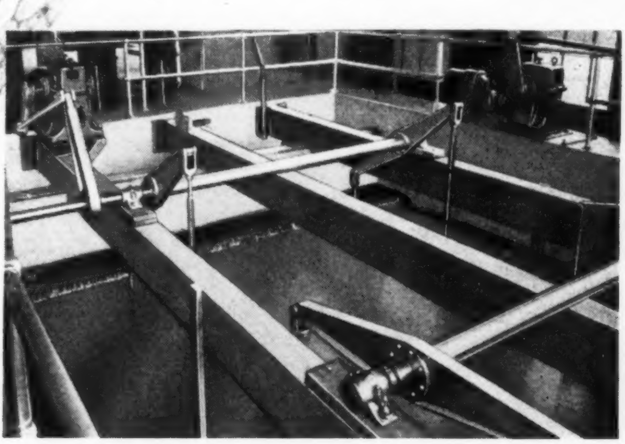
Stuart-Carter "Walking Beam" Flocer proves efficiency

Stuart-Carter "Walking-Beam" Flocer was installed at the Cornell University Water Filter Plant—early in 1948. Normally serving this growing college community of 13,000—the university water plant helped supply the City of Ithaca last summer—during a prolonged emergency breakdown of the municipal water supply system.

This emergency resulted in continuous heavy duty operation for 39 days—often at full pumping capacity; demand was upped from 1,400,000 MGD to 2,300,000 MGD—an increase of 61%!

Rigid laboratory and mixing basin tests were conducted during this "topload" period. The Stuart-Carter overhead drive flocer was more than meeting the heavy emergency demand on the filter plant. ALL water was still being uniformly treated . . . reduction in turbidity was still as high as for normal volumes.





Above: Sketch of Stuart-Carter "Walking Beam" Flocer—designed for and installed at Cornell University Water Filter Plant, Ithaca, N.Y. Right: Mixing basin at Cornell University Water Filter Plant, showing Stuart-Carter flocculation mechanism.

These Cornell tests are just one more proof of the superior efficiency—and top economy—of Carter water and sewage treatment equipment. The Stuart-Carter Flocer is the most efficient in the field of water treatment. Actual field usage has proven it will more than meet the highest demands on your plant. Its broad flexibility of operation makes it extremely economical for raw waters of *any degree of turbidity.* As clearly recorded in the Cornell tests—ALL water was uniformly treated during the abnormally high volume output.

With this exclusive Stuart-Carter design, flocculation of the suspended solids is more efficiently created by the vertical stroke of the inverted troughs. The vacuum on the upstroke gives a fast floc formation—and the turbulence from the down stroke forms a dense, heavy floc which settles easily in the sedimentation basins.

Write today for complete bulletins on all Carter equipment—for both water purification and sewage treatment. Mail the coupon today.
Mutual Sales Agents: Ralph B. Carter Co., Hackensack, N. J., and Stuart Corp., Baltimore, Md. Exclusive Mfgrs.: Ralph B. Carter Co.

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Please send your complete bulletins on water and sewage treatment equipment.

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186 ATLANTIC STREET HACKENSACK, N. J.

RALPH B. CARTER CO.

labelled A. E. Gorman, of Washington, D.C., 'Atomic' and—do you want any other suggestions?—Sig."

* * *

And then there was the letter from Stan Barker of the N.Y. State Dept. of Health in Albany, who wrote: "Dear Doc:—I remember that at the meeting of the Central States Sew. Wks. Assn. in Milwaukee last June, you asked for a new term, to be used instead of 'supernatant liquor' when speaking of the discharge from digestion tanks. I agree with you; most of the time it is not a supernatant liquor and the words are hard to say and to write; and as you say there is no verb for it. Well, here's a suggestion—'Digester Overflow Liquor or DOLIQ'. I can't claim authorship. I heard it at a meeting of Sanitary Engineers representing the Upper Mississippi River and Great Lakes States, but I thought you might like it.—Stan."

You know, Stan, it's funny, but ever since that meeting I've been trying to find the fellow who made that same suggestion to me right at that Milwaukee meeting of the Central States S.W.A. I was talking to "Pete" Wisely of F.S.W.A. and Ted Rudgal of Kenosha when this chap came up and handed me a slip of paper on which was written, "Digester Overflow Liquor or Doliq or DOL." I can't remember the chap, and neither can "Pete" or Ted. Next time you sit in with those engineers who seem to be using the term, find out who originated it.

Incidentally, you may be interested to know that in New York City I hear the operators of the sewage treatment plants call supernatant liquor "Digester Decant Liquor" or "Digester Decant" or "Decant Liquor" or just plain "Decant" which has in its favor the fact that it is both a noun and a verb. What do you think of that?

* * *

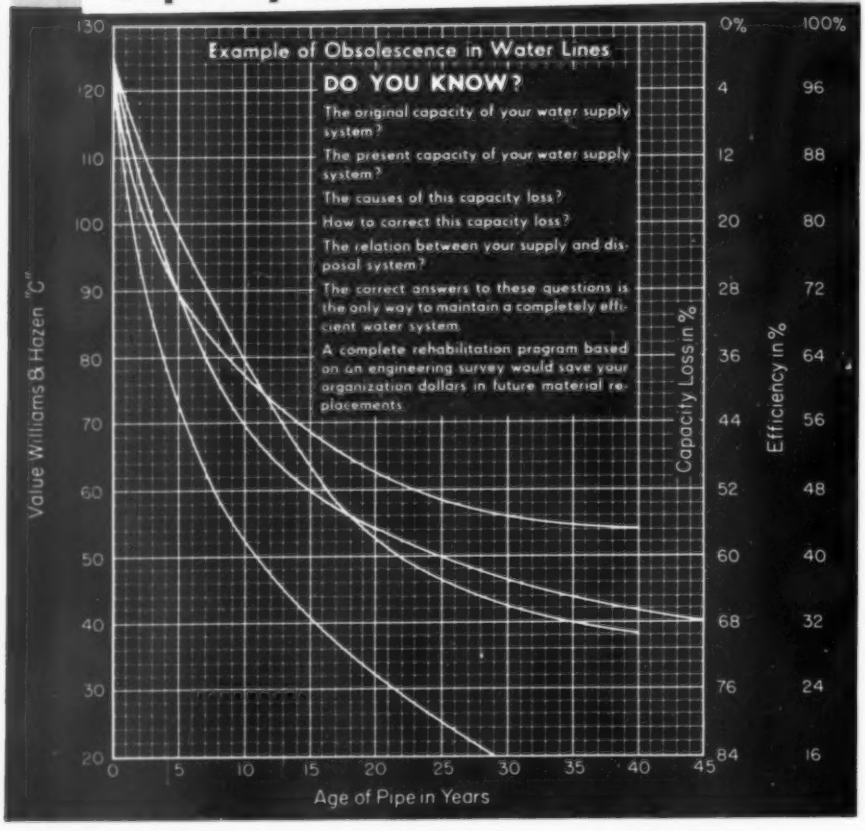
There's another letter I wanted to let you read, but for the life of me, I can't seem to find it. It was from Rollie Leveque, that personality boy who is Sales Manager for Omega Machine Co., in Providence. In it "Rollie" set forth what Plato once said about salesmen. Please, Rollie, may I have another copy, and meanwhile I find this item in another letter you once wrote me:

"I saw Phil Kavanagh of W & T at the Virginia Section meeting and he told me that during a conversation with a small plant operator, he asked the operator what the pH of his water was. The operator replied, 'Oh we stopped buying that stuff and haven't put any pH in our water for ages. We get better results without it.'" Oh, come now, I've heard some malapropisms before in this business but who is pulling whose leg?

* * *

Small World No. 7—My good friend, Linn Enslow, editor of this "sheet" and currently engaged in A.W.W.A. presidenting as an extra-curricular activity, lives in Jackson Heights, Long Island, only a few miles from La Guardia Field. On occasion he goes to the airport to mail copy for this magazine to Chicago, sometimes by bus in the wee small hours. On one of these early morning trips when returning by bus much to his surprise someone behind him called out "Hello, Linn Enslow!" Turning around, Linn discovered that his travelling companion was none other than John R. Mudge, President of Chemical Equipment Co. of Los Angeles, manufacturers of chlorinating equipment—incidentally one of our valued advertisers—who had just flown in from L.A. Small world! Smart John Mudge had learned that the speediest and far less expensive transportation from the airport to his hotel in N.Y. is by bus, connecting with the fast travelling subway from Jackson Heights in.

Do You Know The Rate of Capacity Loss in Your System?


Example of Obsolescence in Water Lines
DO YOU KNOW?
The original capacity of your water supply system?
The present capacity of your water supply system?
The causes of this capacity loss?
How to correct this capacity loss?
The relation between your supply and disposal system?
The correct answers to these questions is the only way to maintain a completely efficient water system.
A complete rehabilitation program based on an engineering survey would save your organization dollars in future material replacements.
Value Williams & Hazen "C"
Capacity Loss in %
Efficiency in %
Age of Pipe in Years
0% 100%
4 96
12 88
20 80
28 72
36 64
44 56
52 48
60 40
68 32
76 24
84 16
130 120 110 100 90 80 70 60 50 40 30 20
0 5 10 15 20 25 30 35 40 45

Actual Trends of Age-Coefficient Relation for Tar-Coated Cast Iron Supply, Transmission and Distribution Mains Eastern Surface Water Supplies.

Now the rate of capacity loss in your system can be determined by engineering methods, by knowing the type of water in the system, the comparative age of the pipe, and the kind of pipe originally installed.

Have a Pittsburgh Pipe Cleaner Company Engineer explain this complete rehabilitation program to you NOW.

From: Report of Committee on Pipe Line Friction Coefficients New England Water Works Association.

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133 Dahlem St., Pittsburgh 6, Pa.

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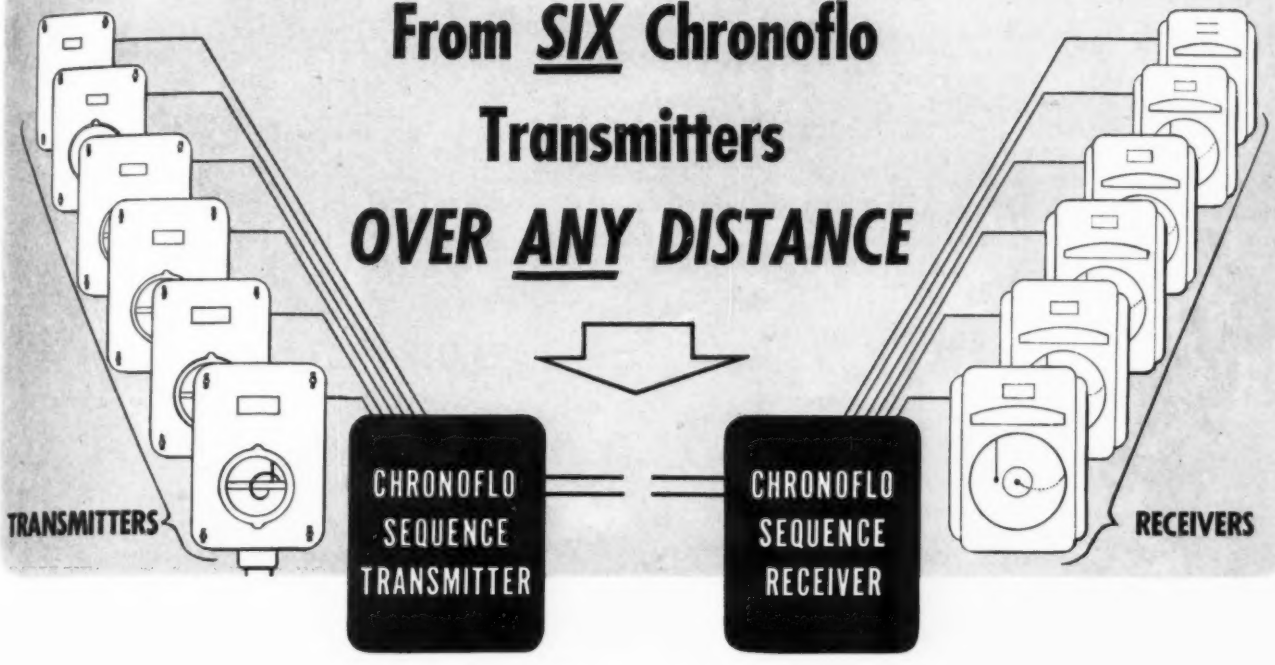
NOW! *ONE* Pair of Wires Forwards Information From *SIX* Chronoflo Transmitters *OVER ANY DISTANCE*

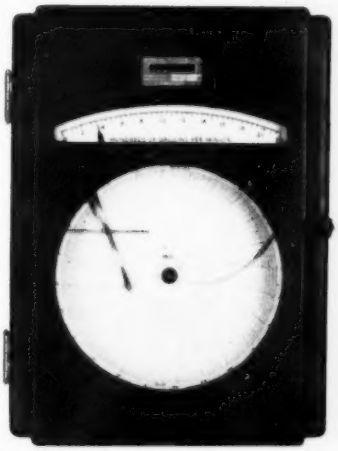


Builders new Chronoflo Sequence System brings substantial savings to long distance telemetering. A single telephone circuit now transmits up to six sets of information from Builders Chronoflo Transmitters,—water level, temperature, pressure, flow, etc.—centralizes control of remote pumps and equipment, and, with reduced personnel, provides round-the-clock operational data from outlying stations.

✓ *CHECK THESE MONEY-SAVING FEATURES!*

- Low wire rental cost for only a single circuit.
- Uses standard Builders Chronoflo Instruments.
- Simpler and less costly than simultaneous transmission, — the Sequence System automatically connects one transmitter after another.
- Fully automatic synchronizing of all transmitters and receivers.
- Operation not affected by normal voltage or resistance variations.

For complete information on Builders Chronoflo Sequence System, address BUILDERS-PROVIDENCE, INC., (Division of Builders Iron Foundry), Providence 1, R. I.



Chronoflo Register-Indicator-Recorder.

BUILDERS PRODUCTS

Venturi, Propeloflo and Orifice Meters • Kennison Nozzles • Venturi Filter Controllers and Gauges • Conveyoflo Meters • Type M and Flo-Watch Instruments Wheeler Filter Bottoms • Master Controllers • Chlorinizer-Chlorine Gas Feeders . Filter Operating Tables • Manometers • Chronoflo Telemeters

BUILDERS PROVIDENCE *Instruments*

Recently saw Lou Frazza, "Transite Pipe's" representative around New York and New Jersey, and Lou wanted to know if I ever found out why plumbers around New York call a cast iron water main "Corporation Pipe." I told him that up at Portland in February at the Famous Portland Clam Chowder Supper put on by Joe Reny and his boys, I heard two explanations. "Reg" Hayes of Hydrotite said it came from "incorporating the service into the main," and Roy Evans of Mueller Brass thought it came from the fact that in the early days most water utilities were privately owned or were corporations; therefore the main was the corporation's pipe; hence, corporation pipe. Roy thought maybe that was the source of the words "corporation stop" or "corporation cock," too. Does any one really know?

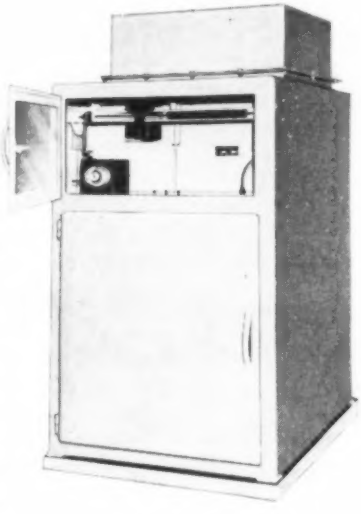
* * *

That'll be all for a month. And don't forget, next month is the annual Ref. and Data issue.

V.T.Y., Doc.

CONTROL YOUR FEEDING BY LOSS IN WEIGHT!

OMEGA CHEMICAL FEEDER



The OMEGA Loss-in-Weight Gravimetric Feeder delivers exactly by weight, the amount per hour required — shows at a glance the pounds of chemical fed. Feeding action is steady, precise and dependable, at rates from ¼ lb. per hr. upward, instantly adjustable by dial over a 100 to 1 range. With the Loss-In-Weight Feeder no catching or weighing of samples is ever necessary to determine the rate of feed. Almost any granular or powdered material, including lumps up to 1¼", can be fed with an accuracy of 99% or better. Automatic proportioning controls and alarm systems are available.

Write for Bulletin 20-23.

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(Division of Builders Iron Foundry)

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OMEGA

THE SPILLWAY

[Overflow from the main section]

L. B. Porter Establishes Cons. Engr. Office

Lyle B. Porter has resigned as Director of Research of the Illinois Water Treatment Co. of Rockford, Ill., and has established a Consulting Engineering Service. Mr. Porter's headquarters will be located at 1707 15th Ave., Rockford, and he will specialize in water treatment, ion exchange, and industrial waste disposal.

Doodlebugging Replaces the Divining Rod

A new form of "doodlebugging", or seismic exploration, is replacing the old divining rod as a means of locating water supplies. While "doodlebugging" has long been used in the southwest searching for oil wells, its application to locating ground water supplies is entirely new. The technic employed also is different.

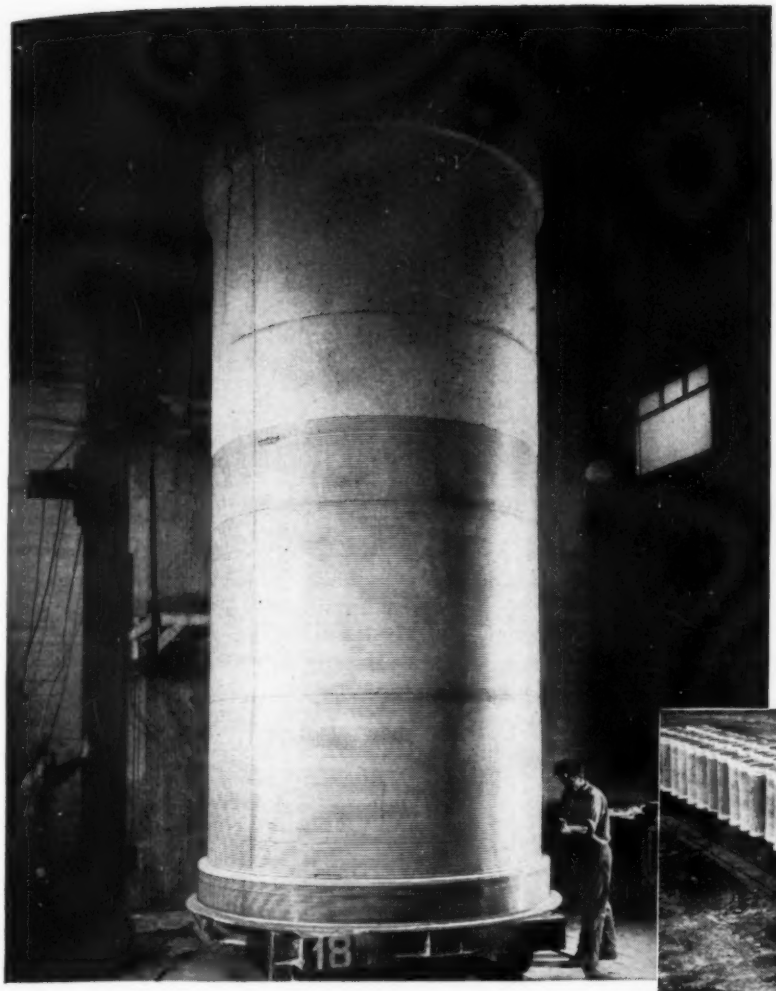
This new seismic exploration method for locating ground water supplies was developed by Rev. Daniel Linehan, S. J., seismologist in charge of the Weston Observatory of Boston College. In his application of seismic explorations, Father Linehan does not actually find water, but merely sounds for geological conditions that should lead to water. Whereas in searching for oil the method employs reflection of sound waves, Father Linehan uses the refraction method, in which the sound waves go through rock or other materials.

The equipment consists of seismological instruments including seismometers and a stick of dynamite which is fired five or six feet below the surface of the ground. Wires from the seismometers to a set of amplifiers carry subterranean sound waves. From the rate of the sound, the observer can determine the make-up of sand, gravel, or rock below the surface. Having determined this geological formation, it is possible to determine whether or not ground water should be present.

Weston, Mass., has used Father Linehan's method to obtain a recent supply, and Naugatuck, Conn., is planning on using this method.

PRESTRESSED CONCRETE PRESSURE PIPE by PRELOAD

....Pioneers in Prestressed Concrete Design and Construction



Winding high tensile strength wire on an 18 ft. length of 84 inch diameter Preload Prestressed Concrete Pressure Pipe at Montreal, Canada.

Finished lengths of pipe stored ready for installation in the new Montreal-St. Lawrence water supply intake.

Specify Preload Prestressed Pressure Pipe to attain the following advantages in economy, performance and capital investment value:—

1. **Thinner wall and corresponding lighter weight.**
2. **High internal bursting strength.**
3. **Great external loading strength.**
4. **Substantial economies due to lower first cost; long-term freedom from corrosion and corresponding sustained flow capacity; low maintenance cost; immediate availability of materials.**

Preload is now applying the well known advantages of prestressed concrete construction to pressure pipe of 20 inch diameter and larger, and also is using the Preload-Rocla Internal Expansion Method to make pressurized, prestressed concrete pipe in diameters of 6 inches and larger.

The illustrations show Preload Prestressed Pressure Pipe for the Montreal Municipal Water Supply System's new intake from the St. Lawrence River—a pipeline approximately 10,000 feet in length designed to eliminate the less desirable Ottawa River water.

Each pipe section of 84 inch diameter is 18 feet long and weighs 18 tons. Utilizing the well known Preload Wire Prestressing System the units are built on the site, a procedure which insures no delays, no transportation problems.

THE PRELOAD COMPANIES

209-11 EAST 37th STREET, NEW YORK 16, N. Y.

Designers and Builders of Prestressed Concrete Storage Tanks and Pressure Pipe
Prestressed Concrete Bridges and Cement Lining of Pipe in Place

The Preload Corporation
New York—Boston—Washington

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929 Porter Bldg., Kansas City, Mo.

PRELOAD TRADE MARK

The Preload Pacific Corporation
333 Kearney St., San Francisco

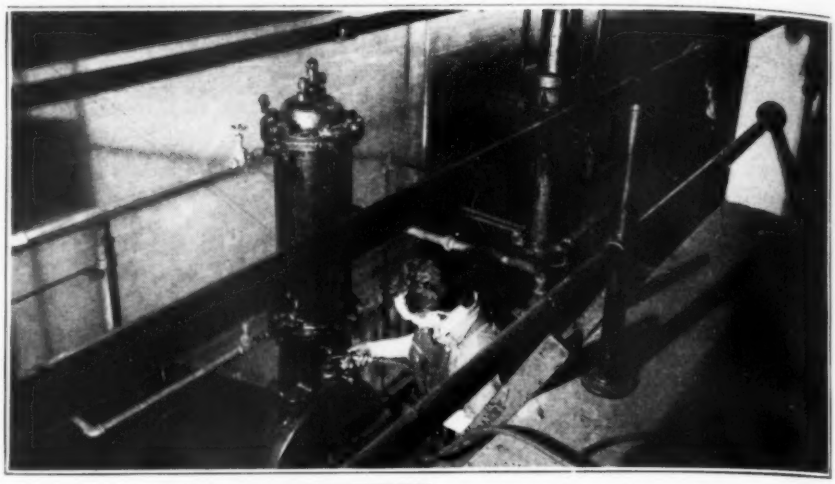
The Preload Co. of Canada, Ltd.
7325 Decarie St., Montreal, Que.

Keeping Valves Clean With Compressed Air

Compressed air is used in cleaning the battery of intake valves at the Baldwin Filtration Plant of Cleveland, Ohio.

The plant has approximately 1,000 feet of compressed air lines, used chiefly in general maintenance work. Approximately 300 feet of these lines are strung along the battery of intake valves which must be cleaned every 100 hours.

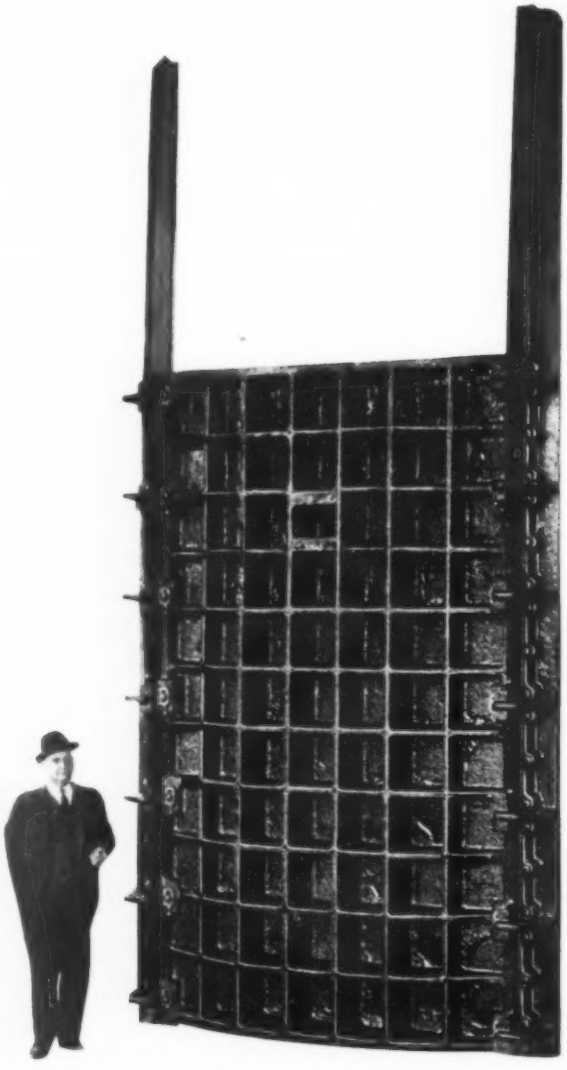
(The accompanying photograph was supplied by the Compressed Air Institute.)



Combination Gas and Water Well

Out in Evansville, Ind., a man by the name of Tapper tapped a 104 ft. well in his back yard, and tapped, not only a water supply but also a gas supply. The gas was not discovered until an explosion blew the lid off the well pit.

Thereafter, Mr. Tapper connected his water pipe to the bottom of the well and put a gas pipe into the top of the well and he now obtains his water from one pipe and gas for his new stove from the other pipe.



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are built to stand long hard usage. Amply proportioned for all stresses of shipment, erection and operation. They may be obtained with manual, hydraulic cylinder or motor operating controls.

THE FILER & STOWELL COMPANY
MILWAUKEE 7, WISC.

FOR BETTER

pH Control

and **WATER TESTS**

there is nothing like

NON-FADING GLASS COLOR STANDARDS

Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

WRITE FOR BULLETIN No. 602

HELLIGE
INCORPORATED
3718 NORTHERN BLVD., LONG ISLAND CITY 1, N.Y.
HEADQUARTERS FOR COLORIMETRIC APPARATUS

CONCRETE PIPE

Gives you Strength, Durability and Economy in...

SANITARY SEWERS

For more than 100 years sanitary engineers have selected and specified concrete pipe for sanitary sewers because it meets all three essential requirements: (1) strength to resist severe impact and to sustain heavy overburdens, (2) durability to render many long years of heavy-duty service and (3) true *low-annual-cost* economy.

STORM SEWERS

Concrete pipe renders outstanding service in storm sewers because it carries off water efficiently. Its smooth, interior finish provides maximum hydraulic capacity and resists the wearing action of abrasive matter. Concrete storm sewer pipe is economical because it's moderate in first cost, has a long life and little or no maintenance cost. That's *low-annual-cost* service.

WATER LINES

Concrete pipe is ideal for water lines because (1) it can be designed to resist high internal pressures, (2) its joints can be made watertight, (3) there is no tuberculation and far less incrustation to impair hydraulic capacity and (4) it minimizes taste, odor and dirty water difficulties. Its reasonable first cost, combined with low upkeep and long life, give *low-annual-cost* service.

PORTLAND CEMENT ASSOCIATION

33 WEST GRAND AVENUE • CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete . . . through scientific research and engineering field work

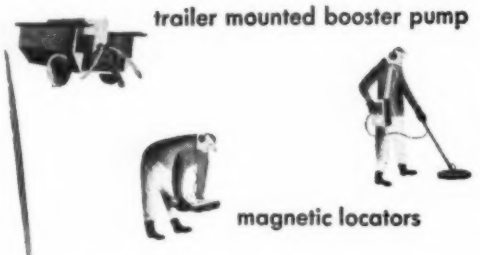
Coal Sizes*

The names given to various sizes of coal are confusing and the buyer often has no idea of the actual size of the coal he is ordering. The following table shows the screen sizes of anthracite coal.

Name	Passes Screen	Retained on Screen
Furnace Coal	4-in. sq.	2¾-in. sq.
Egg Coal	2¾-in.	2-in.
Stove Coal	2-in.	1⅜-in.
Nut (Chestnut)	1⅜-in.	½-in.
Pea	¾-in.	½-in.
Buckwheat No. 1	½-in.	¼-in.
Buckwheat No. 2 (rice)	¼-in.	⅛-in.
Buckwheat No. 3	3/16-in. rnd.	1/16-in. rnd.
Birdseye (Buckwheat No. 3 & 3 mix)	5/16-in. rnd.	1/16-in. rnd.

*Contributed by W. F. Schaphorst, M. E., Newark, N. J.

all this and radio too,

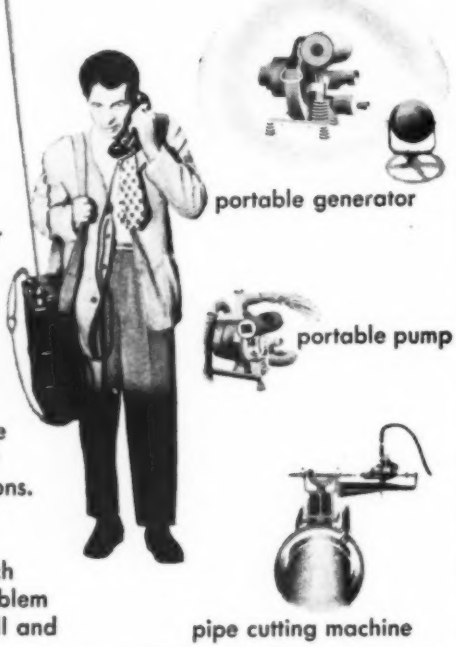


helps NATIONAL clean water mains faster, better and more economically

The highly specialized equipment employed by the National Water Main Cleaning Co. today includes: walkie-talkie radio systems for maintaining constant communication between the point of operation and control valves or pumping stations, magnetic locators for tracing underground pipe, truck-mounted pumps for dewatering, trailer-mounted booster pumps for stepping-up pressure, pipe cutting machines and a tremendous variety of cleaning heads developed to meet the requirements of varying pipe sizes, conditions and layouts.

Even more important than adequate equipment is the experience necessary to cope with all conditions and situations. The nature of the obstruction, varying pipe sizes, unusual pipe layouts, the character of the water — all make each cleaning assignment an individual problem calling for specialized experience, skill and equipment.

We'll be glad to check the condition of your water mains, recommend the required treatment and estimate the cost of National Water Main Cleaning service. Write today.



NATIONAL WATER MAIN CLEANING COMPANY

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28

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Financial Administration Of Municipal Utilities

"FINANCIAL ADMINISTRATION OF MUNICIPAL UTILITIES" is authored by Irving Tenner, Certified Public Accountant and Fiscal Consultant, Chicago, Ill. This book discusses the principles underlining the financial administration of municipal utilities and the procedures to be followed in the applications of these principles. This monograph deals only with electric and water plants, but it is suggested that most of the principles discussed in the book apply to other utilities, such as sewage plants, gas plants, airports, etc.

The book contains 12 chapters devoted to such topics as organization, financial policies, rate structures, budget, debt administration, customer accounts, purchasing, payroll administration, management, accounting, and reports.

The book contains 152 pages, is published by Public Administration Service, 1313 East 60th St., Chicago, Ill., and retails for $3.75 a copy.

Klamath Falls Has Two Kinds of Water

Underground Stream Tapped to Heat Many Buildings and Save Fuel

The bustling southern Oregon town of Klamath Falls, a city of 25,000 is built on a hot spot, which is considered a fortunate situation. Hot ground water beneath the streets has been tapped to heat 400 homes. It heats a swimming pool, two hospitals, a high school, newspaper office, several apartment houses and business buildings. Well temperatures of 150 to 226 degrees F. have been recorded.

A new $3,000,000 veterans' hospital to be built will also use this source of heat. The section of town where really hot water is found at depths varying from 200 to 700 feet is limited. Known locally as Scotchman's Paradise, the natural hot water is corrosive and is not pumped through the heating systems. Instead, a coil or U-shaped pipe is sunk into the hot water, which after being warmed is pumped through ordinary radiators, unit heaters, or radiant heating systems.

Geologists believe that the great fault along which the underground stream flows was caused thousands of years ago by the eruption of Mount Magama, now known as Crater Lake. The water, they believe, is heated either by incompletely cooled lava or by chemical reaction.

FOR EFFECTIVE SEWAGE AERATION

ALOXITE Diffusers provide

- UNIFORMITY OF STRUCTURE
- RUGGEDNESS
- LOW PRESSURE LOSS
- CORROSION RESISTANCE
- DURABILITY

In over 225 plants—with operative installations dating back to 1932—ALOXITE aluminum oxide porous media prove all claims made for them.

Used in various phases of primary and secondary sewage treatments, these tubes and plates assure continuous uniform air supply. Diffused in smaller bubbles, oxygen absorption is higher. More efficient treatment results.

With reasonably clean air supplies, rate of pore clogging is greatly retarded. *Some operators report no diffuser removal for cleaning necessary even after more than ten years service!* This is effected, in part, by the uniform permeability and smooth pore passages of the tubes and plates. "Quiet" diffusers are revived quickly by any of the accepted cleaning methods, such as acid treatment, chlorination, brushing, reburning, etc. Withstanding repeated handlings, these rugged media are used over and over again. Structural deterioration is averted by exceptional corrosion resistance.

Available to advise on specifications, installation and operation of ALOXITE diffusers is an engineering staff familiar with the sewage field. Their background of technical and practical experience may be of invaluable assistance to you. Feel free to consult them. Write Dept. M-108, The Carborundum Company, Refractories Division, Perth Amboy, N. J.

DIFFUSER MEDIA

BY CARBORUNDUM

TRADE MARK

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

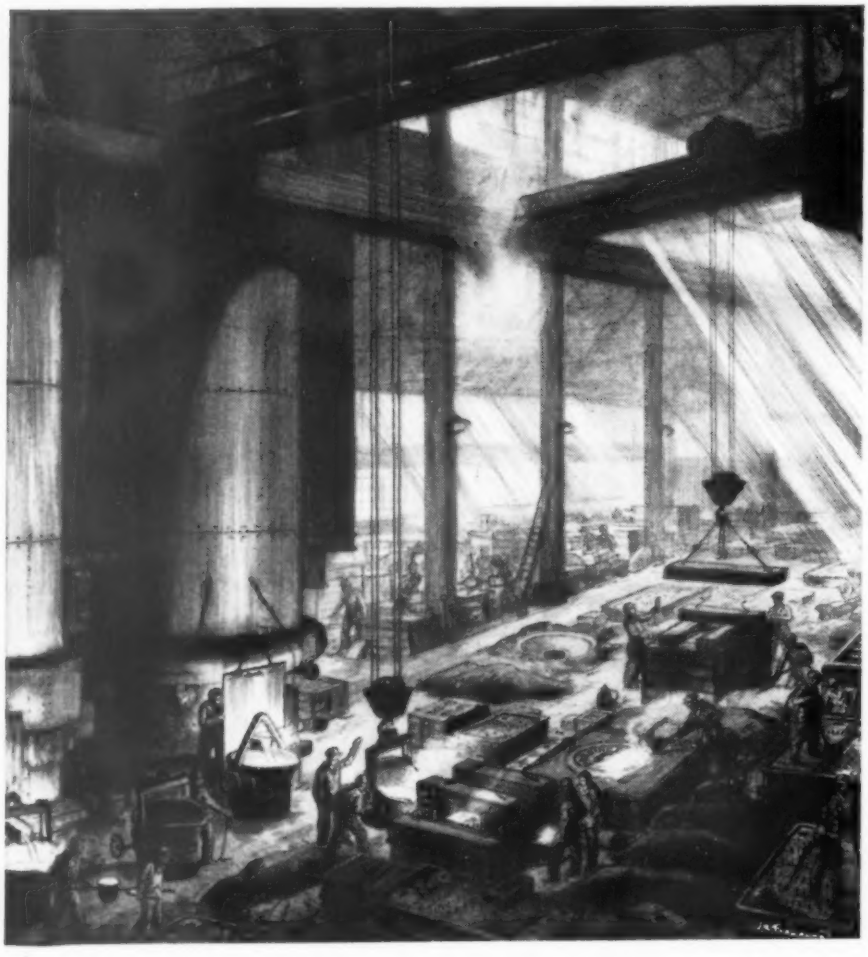
West Va. Potomac Basin Zoning Report

The Potomac Basin Zoning Report of the West Va. Water Commission, was released on July 1, 1948. This report as prepared by the staff of the Water Commission is the second in a series of such reports designed to zone every mile of every major stream in West Virginia.

The first report was on the Kanawha Basin, and with the completion of the zoning work on the Potomac River this brings to 49 per cent completion the job of initial stream definition, according to K. S. Watson, Chemical Engineer in charge of the technical staff of the Commission.

Obviously the report deals only with that portion of the Potomac River Basin which is within the State of West Virginia and all references in the report refer only to that portion.

Persons interested in the methods by which the West Va. Water Commission finds conditions of streams and stream pollution will find this report of considerable interest. A limited number of copies are available from K. S. Watson, Engineer, West Va. Water Commission, 1806 Washington St., E., Charleston 1, West Va.



Birthplace of a Clarifier

Yes—the Hardinge Clarifier, the Automatic Backwash Rapid Sand Filter, Ruggles-Coles Rotary Sludge Dryers, Hardinge Digester Mechanisms and Flocculating Equipment—all get their start in the Hardinge foundry.

The skilled craftmanship which begins here follows each piece of Hardinge equipment throughout its entire manufacturing cycle—through sales engineering and installation—to give you sanitation equipment with maximum efficiency, long life, and low maintenance.

State your problem; write for Bulletin 35-C-15.

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MANUFACTURERS' and EQUIPMENT NEWS

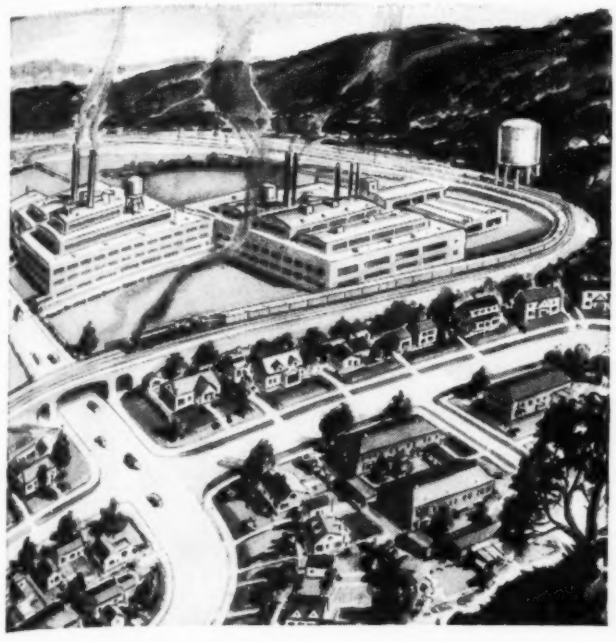
R. W. Hooker Heads Chlorine Institute

Roger W. Hooker, Vice President in charge of sales of the Hooker Electrochemical Co., was elected President of The Chlorine Institute,

Inc., at the annual meeting in January. Mr. Hooker has been associated with the chlorine industry since 1921, when he first joined the Hooker Company. He has been active with The Chlorine Institute since 1940, when he was elected a director. Prior to the recent election he had been vice president of the organization. Mr. Hooker succeeded W. Willard Jacobs of the Niagara Alkali Co., who retired as the institute's president.

Proportioneers Trailer to Visit Southeastern States

After travelling more than 100,000 miles giving demonstrations of %-Proportioneers% equipment, the famous Demonstration Trailer of the company is starting on a trip through the Southeastern States. If you want information on the route of this demonstration unit, write your nearest %Proportioneers, Inc.% for further information.



LONGER SERVICE

At Lowest Cost

FACTORIES, processing plants, railroads etc., the Nation over are buying more and more Layne Well Water Systems and Layne Vertical Turbine Pumps. Here is well water producing equipment that meets every requirement for sustained high efficiency, dependable long life and welcomed economy in operation cost.

Layne well water producing equipment has always been designed and built to outlast any other made. The use of finest materials throughout, plus rugged strength and manufacturing craftsmanship practically eliminates breakdowns and costly repairs.

The production from Layne Well Water Systems is often double and sometimes triple that of conventional type wells and pumps. In some cases one Layne Well Water System produces enough water to replace several less efficient systems. The savings thus enjoyed, have made the change very profitable.

Complete installations by Layne include everything from preliminary survey, exploration, well drilling, pumps and pump installation, delivering the system ready for service, fully tested and operation. For further information, catalogs, bulletins, etc., address LAYNE & BOWLER, INC. General Offices, Memphis 8, Tenn.

LAYNE

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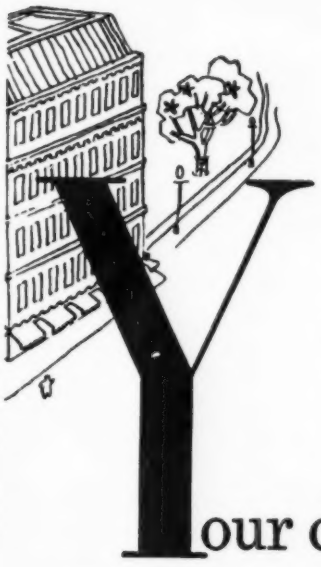
AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio. * Layne-Pacific, Inc., Seattle, Washington * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Minnesota Co., Minneapolis, Minnesota * International Water Corporation, Pittsburgh, Pa. * International Water Supply, Ltd., London, Ontario, Canada * Layne-Hispano Americana, S. A., Mexico, D. F.



Altitude Control Valves by Golden-Anderson faithfully maintain a 3" to 12" water level variation, and are designed to assure unfailing water control under all climatic conditions. A special needle valve adjustment permits proper valve speed to suit any operating requirements, while inherent water cushioning design minimizes surge and water hammer problems. These valves may be arranged with auxiliary equipment to perform a variety of water control services. Write for complete information today.

Your community...

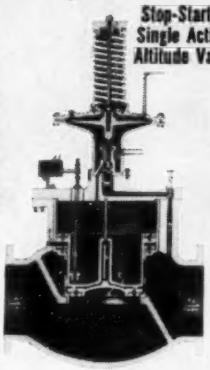
needs the safety and lasting dependability of

GOLDEN-ANDERSON

POSITIVE CONTROL

Valves

Balanced Controlling Float Valve



Stop-Starter Single Acting Altitude Valve

GOLDEN-ANDERSON VALVE Specialty Co.

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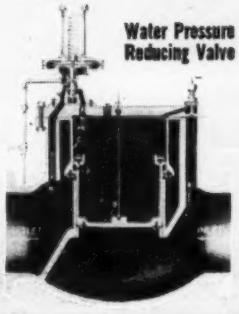
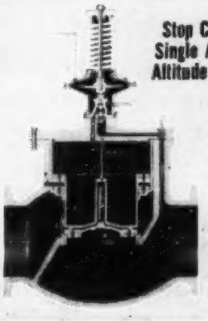


Water Pressure Reducing Valve



Stop Check Single Acting Altitude Valve

Peck Pump & Equipment Co.

L. J. Peck, who resigned as representative of Wallace & Tiernan Co. to buy the Van Nouhuys Pump & Supply Co. last year, has announced a change in the name of his company. Henceforth the company will be known as the Peck Pump & Equipment Co., located at 131 Hudson Ave., Albany 6, N. Y.

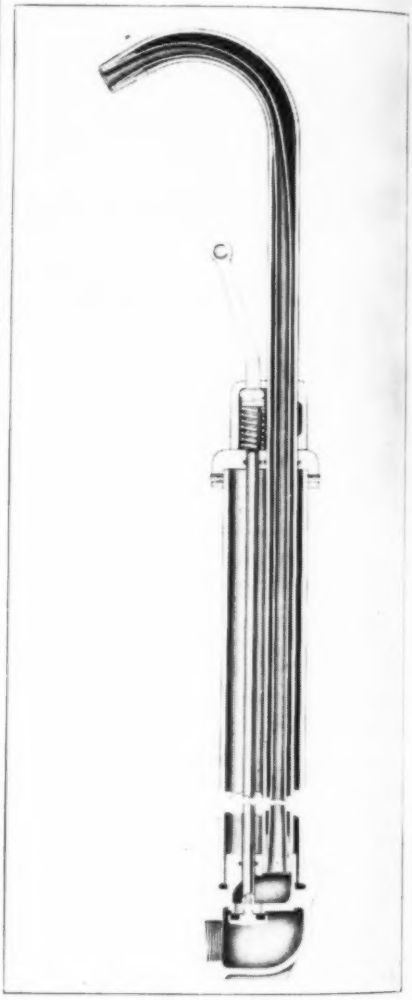
Mr. Peck's company now represents the Peerless Pump Co., A. Y. McDonald Mfg. Co., and a complete line of sewage treatment equipment manufactured by Yeomans Bros. Co. of Chicago.

According to Mr. Peck's announcement, with the change of name his new company will handle deep well turbine pumps, centrifugal pumps of the deep well turbine type, centrifugal industrial sewage bilge and water systems, and water treatment equipment including filters, water softeners, chlorinators, and chemical feeders.

400

Self De-icer Hydrant

Crane Co., Chicago, has introduced a new design in "frost-proof" hydrants which eliminates the need for underground pits, gravel boxes, drainage lines, sump pumps, etc.



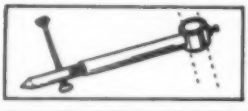
The key to this design is a rubber-lined riser spout inside of which, for the entire length of the hydrant to well below the frost line, is a rubber tube. The expansion and contraction of this rubber tube prevents solid freezing of the hydrant and allows such ice as does form to be quickly removed and flushed out.

For further information on this new type of frost-proof hydrant, use a Reader Service Card on which is entered the above key number and your name and address.

NEW—"FLEXIBLE" LOWER MANHOLE JACKS

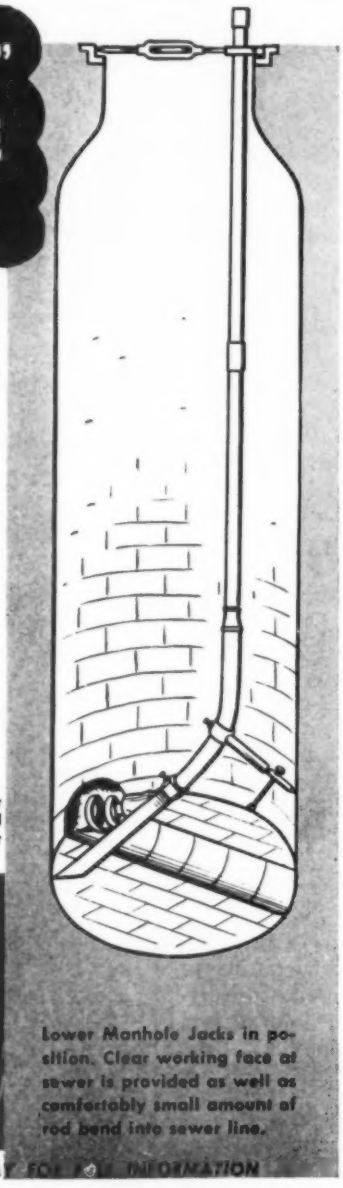
SAVE TIME AND WORK AND EQUIPMENT

"FLEXIBLE" experience again provides new methods of simplifying tough jobs. These two new Lower Manhole Jacks brings sewer and line cleaning operations another step further into the open. They also speed tool changing. Note how the coupled rod guide is quickly, firmly, simply anchored at the bottom of the manhole. Also note that the face of the bell is held away from the lip of the sewer line itself. This enables operators to see roots before they jam tight in the rod guide.



Adjustable Back Jack (Optional use). Perfect for getting additional anchorage of rod guide. Sold separately.

Adjustable Foot Jack. Ideal for use with proven "Flexible" Steel Rod system of cleaning sewer lines. Sold separately.



Lower Manhole Jacks in position. Clear working face at sewer is provided as well as comfortably small amount of rod bend into sewer line.

ASK YOUR NEAREST "FLEXIBLE" OFFICE TODAY FOR [illegible] INFORMATION

FLEXIBLE SEWER-ROD EQUIPMENT CO.

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for buying Blaw-Knox Grating

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1. STRONG electroforged construction for easy erection.
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BLAW-KNOX ELECTROFORGED STEEL **GRATING**

You can't afford to miss it!

WATER AND SEWAGE WORKS

A magazine which specializes in water supply, sewage disposal and industrial waste, to help you solve your problems.

Read by over 735 Consulting Engineers who specialize in this field—a significant testimony to the quality and reliability of the publication.

If not a subscriber—place your order NOW and be sure of a copy of the new revised REFERENCE AND DATA NUMBER. Fill in coupon, and mail today to

WATER AND SEWAGE WORKS

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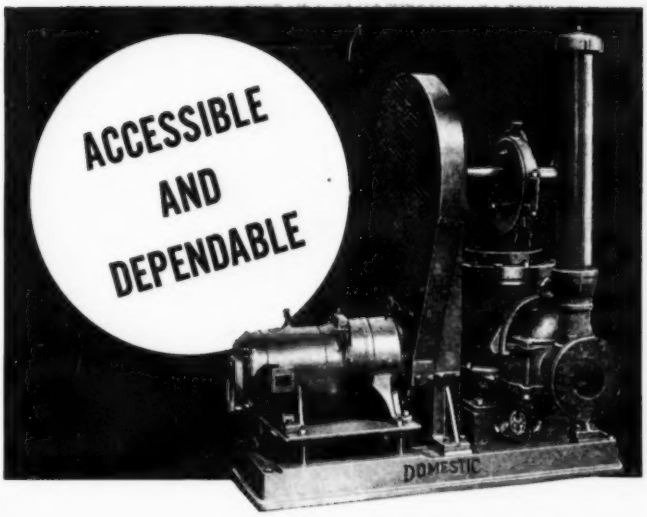


"DOMESTIC"

PLUNGER SLUDGE PUMP

DESIGNED AND BUILT FOR THE EFFICIENT PUMPING OF PRIMARY SEWAGE SLUDGE

OUR 44 years of engineering and manufacturing experience assure superior construction and service.

DOMESTIC plunger sludge pumps are today performing herculean tasks in every state in the Union, many after decades of gruelling use.

Types Available: 6"—8½"—10"—and 12¼" in single, duplex and triplex types.

Capacities from 35 G. P. M. to 375 G. P. M. at heads up to 115 feet.

All sizes 5½" stroke, adjustable eccentric type.

Furnished with gear head motor and roller chain drive or constant speed motor and V belt drive.

"If it's a job for a Pump— it's a job for Domestic"

"DOMESTIC"

ENGINE & PUMP COMPANY

A DIVISION OF EMPIRE INDUSTRIES, INC.
613 QUEEN ST.
SHIPPENSBURG, PENNA.

Pioneer Water Conditioning Firms Join Forces

Two old-time water conditioning companies in Illinois have joined forces. They are the Elgin Water Softener Corp., Elgin, Ill., and the Illinois Water Treatment Co., Rockford, Ill.

Each company will retain its name identity and personnel but through a consolidation of manufacturing operations, production economies can be effected and passed on to the user. In addition, an integration program will improve the scope of services available throughout the country.

U. S. Pipe's 50th Anniversary

U. S. Pipe & Foundry Co. of Burlington, N. J., celebrated its 50th anniversary in March. A large new research and development laboratory has recently been completed at Burlington to supplant facilities established about 20 years ago.

The company produces cast iron pipe and fittings in four modernized plants and carries on operations at three other plants. The company pioneered the production of deLavaud centrifugal casting in this country in 1921.

Marx Dresser Corrosion Engineer

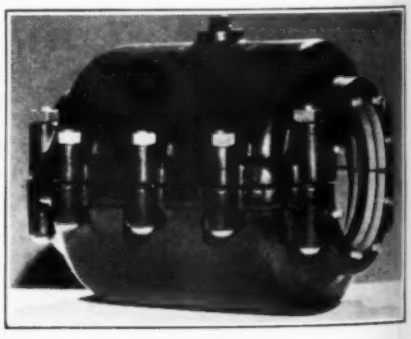
Dresser Manufacturing Division, Bradford, Pa., has announced the appointment of Paul F. Marx as corrosion engineer. In his new position, Mr. Marx will institute intensive research on corrosion problems affecting gas, oil, water, and other types of piping, with particular emphasis on the protection of pipe joints.

Mr. Marx formerly served as chief corrosion engineer for Williams Brothers Corp., maintainers of the "Big Inch" pipeline.

401

Bell Repair Sleeve

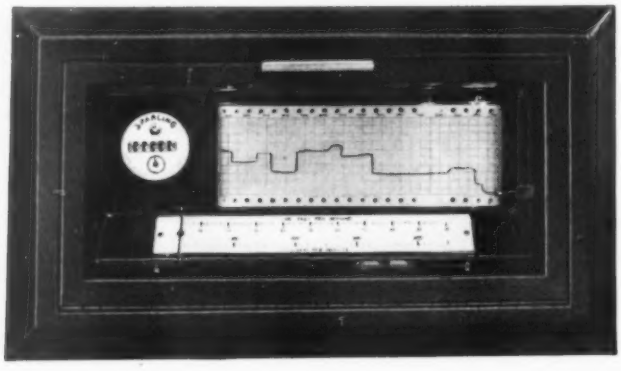
Dresser Manufacturing Division, Bradford, Penna., has developed a new style Dresser "Bell-Pack" Sleeve. Shown in the accompanying photograph, this new item is economical, fast, and permanent for repairing



split and broken bells, mechanical joints and couplings. It is light in weight and easy to install and may be obtained in 3 to 24-in. sizes, to fit all joints.

To obtain further information about this new repair sleeve, mail a Reader Service Card on which is entered the above key number and your name and address.

SPARLING MAIN-LINE METERS



Accurate MAIN-LINE Measurement Pays

Efficient operation is based on actual figures—not guesswork! The Totalizer-Indicator-Recorder shown above gives you facts you *need* to know about flows in your lines 2-inch and up. The 60-day chart furnishes invaluable records. Auto-metered controls, too, may be added when you install a SPARLING Meter.

Equipment for YOUR Particular Needs

Consistently accurate measurement over a wide flow-range is assured, and you can make your own installations quite easily. A wide range of styles and sizes to meet your requirements.

Quotations and Bulletin 310 come at your request

R. W. SPARLING Manufacturers of WATER MEASURING EQUIPMENT

LOS ANGELES 54.....Box 3277 Terminal Annex
CHICAGO 8.....1500 South Western Ave.
BOSTON 8.....6 Beacon Street
622 Broadway.....CINCINNATI 2
101 Park Avenue.....NEW YORK 17
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ATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

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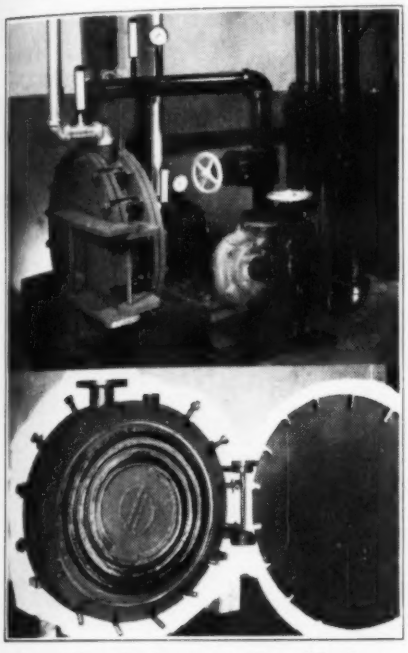
402

Heat Exchanger

The Dorr Co., 570 Lexington Ave., New York 17, N.Y., has redesigned and developed a spiral heat exchanger to meet specific requirements of sewage sludge heating. The unit, originally developed in Sweden, has been thoroughly tested in this country and abroad for other purposes and has been subjected to successful experimentation in sewage sludge heating in this country.



Spiral Heat Exchanger at Joint Meeting, Rutherford, E. Rutherford, and Carlstadt, N.J.

Essentially, the spiral heat exchanger consists of two concentric spirals welded together to make alternate hot water and sludge liquor passageways. At no point is it possible for the heating water to come in direct contact with the sludge liquor. In operation, a portion of the sludge liquor is continuously circulated through one spiral, while hot water is pumped counter-currently through the other as shown in the accompanying sketch. Control of the heating operation is simple and is adjusted merely by varying the amount of hot water being pumped. A check of performance is available by comparing inlet and outlet temperature differences at the exchanger.

The spiral heat exchanger is supplied at present in nine sizes, designated as numbers 14 to 150 inclusive, the number in each case indicating the number of square feet of heating surface provided.

To obtain further information on this new unit, use a Reader Service Card on which is entered the above key number and your name and address.

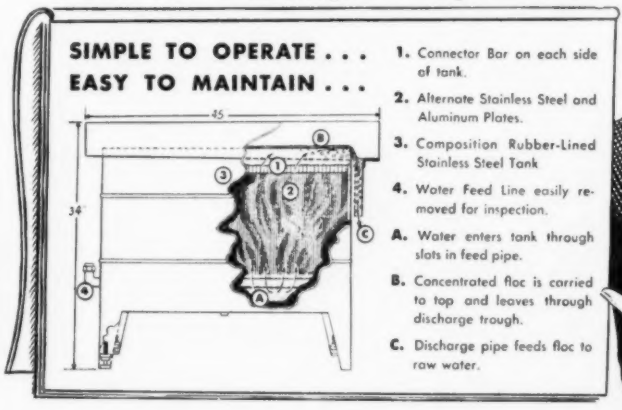
For Industrial And Municipal Water Treatment Plants

Alhydro FLOC PRODUCER

FOR MORE EFFICIENT WATER CLARIFICATION

with

Reduced Handling & Freight Costs

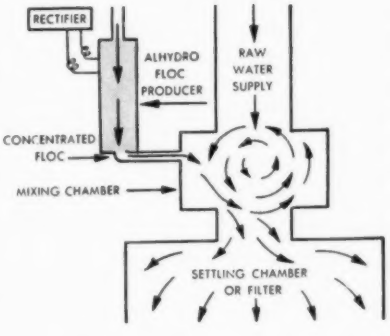

SIMPLE TO OPERATE . . .
EASY TO MAINTAIN . . .
45
34
1. Connector Bar on each side of tank.
2. Alternate Stainless Steel and Aluminum Plates.
3. Composition Rubber-Lined Stainless Steel Tank
4. Water Feed Line easily removed for inspection.
A. Water enters tank through slots in feed pipe.
B. Concentrated floc is carried to top and leaves through discharge trough.
C. Discharge pipe feeds floc to raw water.

The ALHYDRO unit produces concentrated aluminum hydroxide floc by low voltage electrolytic decomposition of easily replaced aluminum plates. Alhydro helps erase your chemical storage and handling problems by using only 69 lbs. of aluminum to treat as much water as nearly ¾ ton of ordinary coagulants. Alhydro reduces freight costs, too, no heavy, bulky chemicals need be shipped to your plant. Of course, the necessity for chemical feeders is completely eliminated.

These are additional advantages: Easily controlled production of completely stable floc . . . efficient coagulation regardless of water temperature, clarity or pH over a wide range.

One Alhydro unit will treat an average of 300,000 gallons of water a day. The units may be installed singly or in multiples.

This installation of ALHYDRO FLOC PRODUCER in your water treatment plant . . .



Produces better water at competitive cost . . . Usually eliminates need for conditioning or correcting water before or after treatment . . . Offers simplicity of operation . . . Minimizes storage problems . . . Gives easily controlled floc concentration

DESCRIPTIVE FOLDER - - FREE!

This folder describes and illustrates the operational advantages of the Alhydro Floc Producer. See how you can simplify the treatment of drinking water or water for industrial use. Write for free copy today.

ALHYDRO, INC. DEPARTMENT 48 516 N. CHARLES ST., BALTIMORE 1, MD.

A .S. Rubin, Jr., Sales Mgr. for Marlow Pumps

Marlow Pumps, Ridgewood, N.J., has announced the appointment of Andre S. Rubin, Jr., as sales manager. Mr. Rubin has been affiliated with the company since 1942 when he became assistant to the late A. S. Marlow, Sr., founder of the organization.

Sheffler-Gross to Represent Mc Alear in East

The McAlear Mfg. Company of Chicago, for more than 30 years manufacturer of specialties for controlling the flow of steam, air, oil, gas, and water, announces that the Sheffler-Gross Company of Philadelphia has been appointed as exclusive sales representative for the McAlear Co. in that territory.

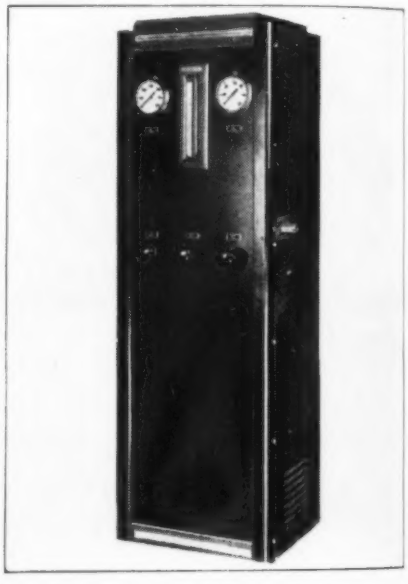
The Sheffler-Gross Company is completing its 29th year in business in Philadelphia handling all kinds of special problems in the control field for heating and power plants.

403

New Chlorinator

Fischer & Porter Co., Hatboro, Pa., has developed a new, inexpensive and mechanically simple chlorine dispenser, known as the "Rato-Chlor."

The "Rato-Chlor" dispenser is assembled from standard components, each of which is particularly designed for chlorine service. It is a "dry vacuum" chlorine dispenser which uses no water seals, bell jars, poppets, or similar devices.



Chlorine from the cylinder, drum or tankcar is filtered first to remove gum-forming hydrocarbon impurities and is then delivered to the "Rato-Chlor" unit at a controlled pressure of —20 in. W.C. Flow rate is set by adjusting a needle-type regulating valve and is measured accurately by a "Flowrator" meter calibrated to indicate pounds per day of chlorine gas. A vacuum is created by an ejector and kept uniform by a vacuum regulating valve. The ejector also mixes a dilute chlorine water solution which it discharges through a distributor into the water being chlorinated.

To obtain further information on this new unit, use a Reader Service Card on which is entered the above key number and your name and address.

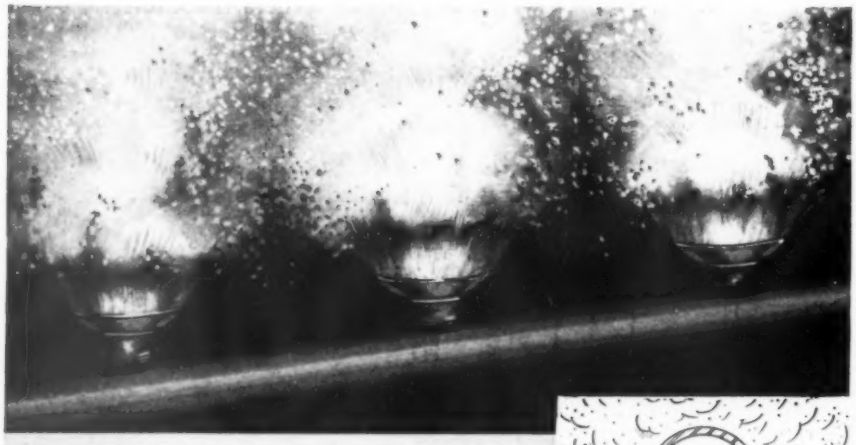
FOR SEWAGE, WASTE AND WATER TREATMENT

IMPINGEMENT AERATOR

DIFFUSAIR

PRE-AERATION...ACTIVATED SLUDGE...CARBONATION

The principle involved consists of a water jet, impinging on a hydraulic bowl placed over an air stream. This causes physical contact and shearing between the two masses at the bowl periphery. The Impingement Aerator DIFFUSAIR produces smaller bubbles than any other known form of air diffusing. Write for Bulletin 17S31.



PROVEN BETTER 5 WAYS

1 Only 3 to 4 lbs. of Impingement Water Pressure Required.
2 High Oxygen Absorption — Air Requirement Reduced.
3 Oxygenation Rate Adjustable Over A Wide Range.
4 No Pores To Become Clogged.
5 No Air Filters Required.

WALKER PROCESS EQUIPMENT INC.
EQUIPMENT • EQUIPMENT ENGINEERING
AURORA • ILLINOIS
PROQUIP

R. B. Seymour Returns to Atlas Mineral Products

Announcement has been made that Dr. R. B. Seymour, formerly chief chemist of the firm, has returned as executive vice president and general manager. Dr. Seymour has been associated with Goodyear Tire & Rubber

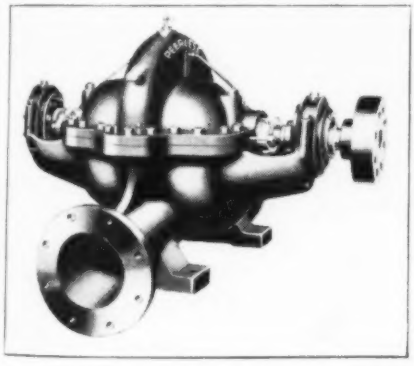
Co., Monsanto Chemical Co., director of the Industrial Research Institute of the Univ. of Chattanooga and Director of Special Products Research for Johnson & Johnson.

While chief chemist of the Atlas Mineral Products, Dr. Seymour was associated with the development of several of the corrosion resistant cements, linings, and protective coatings now manufactured by the company.

404

Centrifugal Pump

Peerless Pump Division, Food Machinery and Chem. Corp., Los Angeles 31, Calif., has announced an augmented line of horizontal centrifugal pumps. With a wide capacity range of up to 60,000 gpm. against heads



up to 300 ft., these pumps are designed for general purpose pumping of water and alkaline fluids at temperatures up to 300 deg. F. These pumps are designated as Peerless Type A, and are of single stage, double suction, split case design, available in sizes from 1½ to 48-in.

To obtain further information on these new centrifugal pumps, mail a Reader Service Card on which is entered the above key number and your name and address.

WARREN
Solves Your
PIPE
PROBLEMS
BELL & SPIGOT PIPE • FLANGE PIPE • MECHANICAL JOINT PIPE • FLEXIBLE JOINT PIPE • SPECIAL CASTINGS • SHORT BODY BELL & SPIGOT SPECIALS •
Warren Cast Iron Pipe and Fittings can be supplied in all sizes 2" to 84" with all types of joints and in accordance with Standard Specifications. Specify "Warren Pipe" for your next job.
Take advantage of our large stock of non-standard patterns, when in need of special castings to meet your individual requirements.
Warren
FOUNDRY & PIPE CORP.
11 BROADWAY — N.Y.C.
WARREN PIPE CO. of MASS. INC.
75 FEDERAL ST., Boston, Mass.

BOND-O

A safe self-caulking, self-sealing compound for jointing water mains. Used with complete confidence. Machine-blended for absolute uniformity. All BOND-O contains a germicide to inhibit oxidation by sulfur bacteria.

Northrop & Company, Inc.
SPRING VALLEY, N. Y.

Every Bond-o Joint is a Good Joint

LaMOTTE
Water Soluble pH Indicators
(Sulfon-phthalein Series) pH 0.2-9.6

Originally developed in the LaMotte Laboratories.

Are of the same superior quality as the acid form hitherto available for pH work. Instantly soluble in distilled water. No alkali required—No heating necessary.

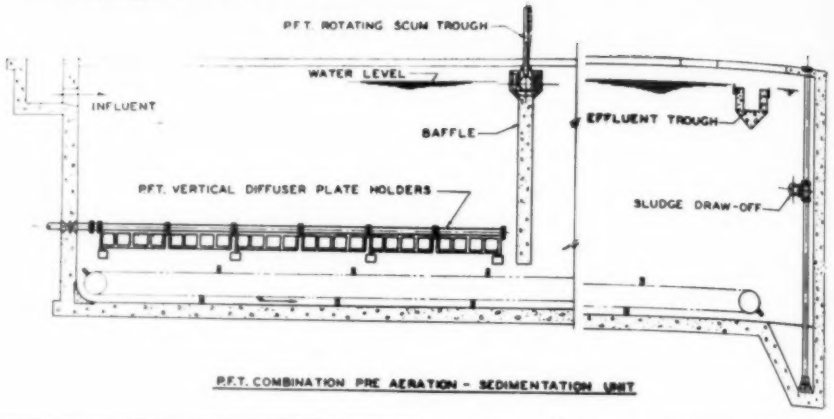
LaMOTTE CHEMICAL PRODUCTS CO.
Dept. WSW Towson, Baltimore 4, Md.

405

Sewage Preaeration

Pacific Flush - Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill., has adapted preaeration to fit existing settling tanks for improved primary treatment. This adaptation makes possible improvement of primary treatment by adding a preaeration stage without extensive and expensive alterations in the existing or planned plant layout.

PFT preaeration equipment is readily adapted to conventional type rectangular settling tank mechanisms, as shown in the accompanying drawing. Merely extending the inlet end of the tank is sufficient to include the PFT plate holders. These vertical cast iron plate holders contain standard porous plates arranged for easy removal and servicing.



P.F.T. COMBINATION PRE AERATION - SEDIMENTATION UNIT

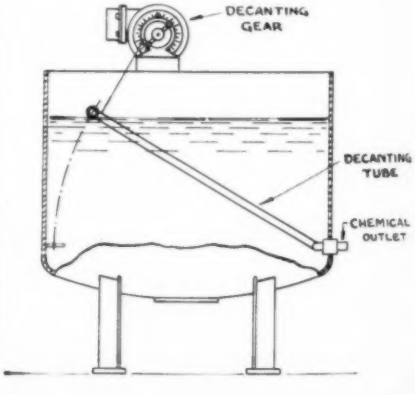
PFT Preaeration provides agitation and mixing and adds oxygen to raw sewage to prevent septicity in the settling compartment. It also improves settling results and increased removal of suspended solids and B.O.D. Several installations of this new equipment have been made.

To obtain further information about this new equipment, mail a Reader Service Card on which has been entered the above key number and your name and address.

406

Decanting Gear for Water Softeners

Worthington Pump and Machinery Corp., Harrison, N.J., has announced a new decanting gear used for automatically lowering the swing-pipe decanting tube in a chemical agitating tank which feeds chemicals to the softener in proportion to the raw water flow.



The operation of this decanting gear is paced by the raw water meter and the dial indicates the amount of chemical liquid in the tank. When the tank is recharged, the decanting tube is raised to its starting position by cranking.

Operating results attest overall efficiency . . . . . of

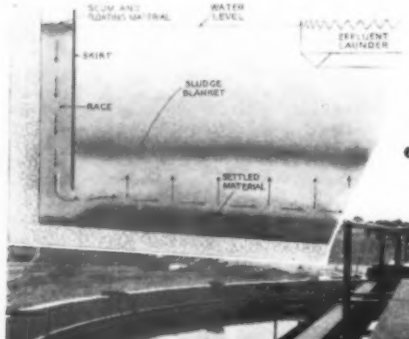
YEOMANS Spiraflo CLARIFIER with tangential inlet

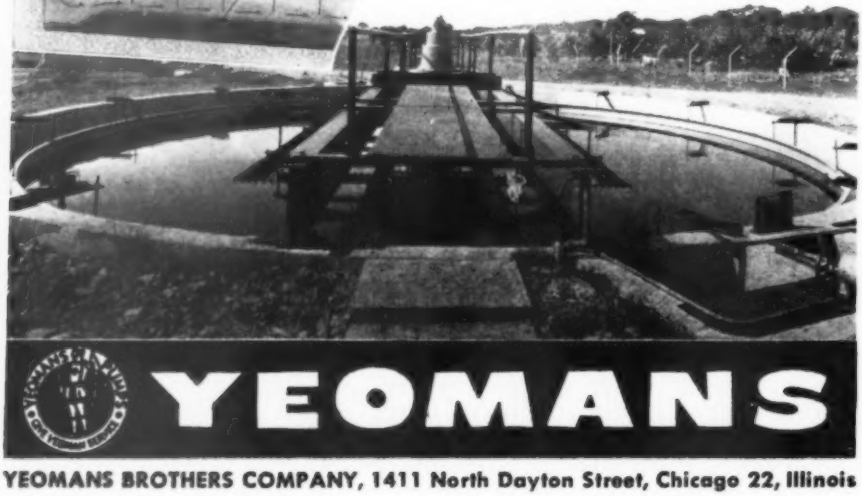
Radically different from other types of clarifiers, Yeomans Spiraflo Clarifier is demonstrating in scores of installations its exceptional efficiency in BOD and solids removal—results directly attributable to these design features:

- **Sewage enters the main clarification compartment at the bottom, after having spiraled through an annular race around the periphery of the tank**
- **Scum, grease oil and floatable materials are automatically removed from the annular race—therefore cannot pass on to the filter and clog distributor nozzles**
- **Raw sewage flows upward through a sludge blanket toward centrally located effluent weirs—increases flocculation and removal of solids**
- **Construction costs are minimized because of straight-wall design and elimination of costly reinforced concrete effluent troughs**
- **Pre-aeration can be accomplished inexpensively by installing air diffusion tubes in the race**

Spiraflo clarifiers can be installed in water treatment and in either trickling filter or activated sludge sewage treatment plants. A highly efficient overall plant reduction is achieved when the Spiraflo is used in conjunction with the "Aero-Filter" high capacity trickling filter system. Spiraflo clarifiers are the logical choice for primary treatment plants, especially those treating strong industrial wastes.

Bulletin 6790 contains full information with performance data and construction cost estimates—write us for it.





YEOMANS

YEOMANS BROTHERS COMPANY, 1411 North Dayton Street, Chicago 22, Illinois

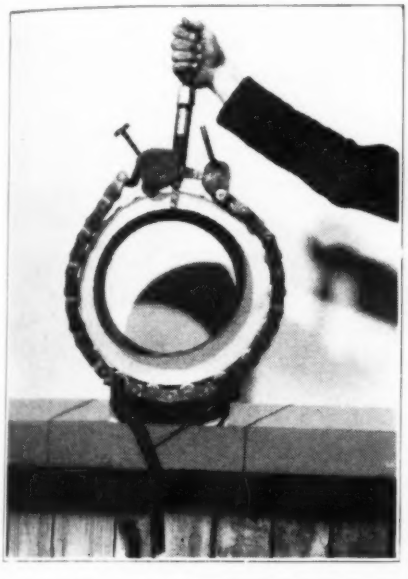
To obtain further information on this new unit, use a Reader Service Card on which is entered the above key number and your name and address.

407

Asbestos Cement Pipe Cutter

H. D. Fowler Co., 9th & Lane St., Seattle 14, Wash., has begun distribution of a new type, low cost asbestos cement pipe cutter.

This cutter, which is easily operated by one man, will cut any of the varieties of asbestos cement pipe on the market. It is a spring load pipe cutter with few parts and requires no as-



sembly for use. It is light in weight, self-adjusting, and equipped with a fast cutting, abrasive-resistant knife which is easy and inexpensive to sharpen.

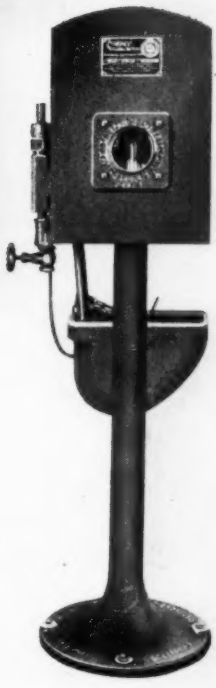
The Spring Load A-C pipe cutter is available in sizes from 3 to 8 in. pipe. One model will handle all of these diameters, and for larger pipe the unit can be quickly enlarged with extra parts.

To obtain further information about this new pipe cutter use a Reader Service Card on which is entered the above key number and your name and address.

Executive Changes at Dearborn Chemical

Earl M. Converse has been appointed Senior Vice-President and Eugene P. Fager was elected Vice-President and Industrial Dept. Manager of the Dearborn Chemical Co. of Chicago. Mr. Converse has been with the company since 1902, and Mr. Fager joined the company in 1920.

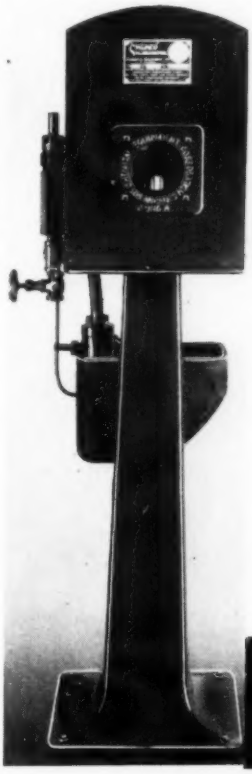
Chemco
CHLORINATORS



Chemco Chlorinators are the result of nearly 25 years experience in water treatment and are used in 42 of the 48 states and foreign countries.. They have outstanding design features as shown below...

CHEMCO Type M-5
CHLORINATOR
CAPACITY RANGES
0-10 lbs. per 24 hours

CHEMCO Type M-3
CHLORINATOR
CAPACITY RANGES
0-10, 0-15, 0-25
lbs. per 24 hours



1 *CHEMCO Chlorinators are simple, sturdy and foolproof in design.*

2 *CHEMCO Chlorinators are all based on vacuum design*

3 *CHEMCO Chlorinators can be flooded with water without damage.*

4 *CHEMCO Chlorinators have no regulator plates, springs or diaphragms to eat out and cause expensive repair cost.*

5 *CHEMCO Chlorinators have no moving parts working in an atmosphere of wet chlorine gas.*

For further information and literature, write

CHEMICAL EQUIPMENT COMPANY

CHEMCO Type M-1
CHLORINATOR
CAPACITY RANGES
0-10, 0-25, 0-50
0-100, 0-200, 0-300
lbs. per 24 hours

P. O. BOX 3098, LOS ANGELES 54, CALIFORNIA

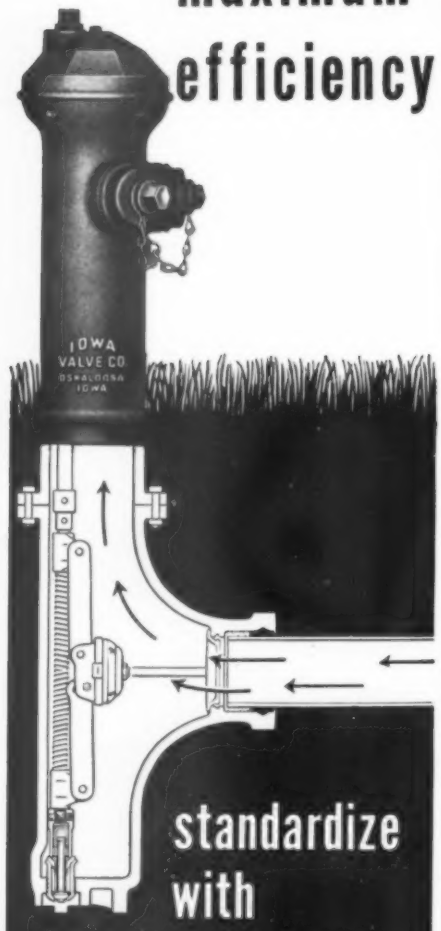
911 Harrison St.
San Francisco 7
California

205 W. Wacker Dr.
Chicago 6
Illinois

30 Church St.
New York 7
New York

Offices or Agents in Principal Cities of the U.S.A. and Throughout the World

for maximum efficiency



standardize with IOWA hydrants

Two piece operating nut with special adjustment screw solves the problems of expansion and contraction . . . makes Iowa hydrants easy to operate at all times.

Positive operating mechanical drain valve can be removed along with all other working parts through top of hydrant without special tools.

Fixed position of valve arms makes leaking impossible should standpipe be broken.

Unrestricted water flow gives full pressure at extreme low loss of head.

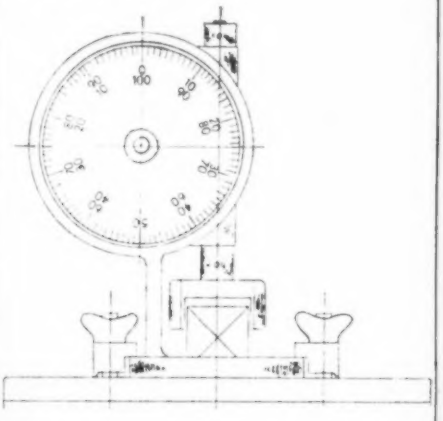
Built to conform to the latest A.W.W.A. specifications.

IOWA VALVE COMPANY
201-299 N. Talman Avenue • Chicago 80, Illinois
A subsidiary of James B. Clow & Sons

408

Revolution Counter for Power Wrench

Lee Hydraulic Co. has developed a simple and practical revolution counter for use with a Bardwell power wrench. It can also be designed to be attached to wrenches already in service.



This revolution counter is reversing; it adds and subtracts in both directions; it can be reset at zero or any position on the scale in a matter of seconds, and can be attached or removed in a few seconds.

To obtain further information on this new unit, use a Reader Service Card on which is entered the above key number and your name and address.

409

Emergency Lighting System

Electric Cord Co., 30 Church St., New York, N.Y., has developed an automatic emergency lighting system

known as the "Minuteman." This system supplies instant, automatic emergency light from its own power when the usual source of current fails. It contains two lamp heads,

LEADITE

The Pioneer Self-Caulking Material for C.I. Pipe

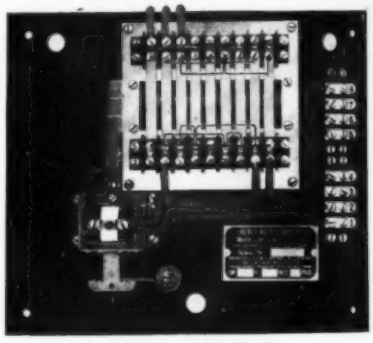
Widely Known

and used by water works men

LEADITE saves in cost of material . . . in caulking charges . . . in digging of large bell holes . . . in cost of trench pumping! Makes a good, tight, lasting joint!

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking



3-PUMP ALTO-TROL

The Alto-Trol

The Alto-Trol equalizes the wear on two or more pumps. It is an electrically operated sequence changer used to alternate the cycle of operation of two or more pumps or similar pieces of equipment. It is used with any standard pilot control, such as any ROTO-TROL or any pressure, float or vacuum switch. No extra circuit or set of contacts is required for its operation. Simple, trouble-free, dependable. Designed for use with two or more pumps.

Write for engineering data

Water Level Controls Division of
HEALY-RUFF COMPANY
783 HAMPDEN AVE. ST. PAUL 4, MINN.

each of which delivers about 100 watts of light and is capable of illuminating approximately 10,000 square feet for about five hours.

The unit is plunged into a regular circuit and in the case of failure of the power, the light goes on automatically. When the power comes back on, the built-in charger restores the power to the battery for the next emergency.

For further information on this unit, use a Reader Service Card on which is entered the above key and your name and address.

Hooker Announces Executive Changes

E. R. Bartlett, president of the Hooker Electrochemical Co., has announced the resignation of H. M. Hooker as chairman of the board of directors of the company. Mr. Hooker will continue as a member of the board of directors.

R. L. Murray

R. W. Hooker

At the same time, R. L. Murray, who was vice-president in charge of development and research, was made executive vice-president, and R. W. Hooker, who has been vice-president and sales manager, is now vice-president in charge of sales. J. H. Babcock, formerly manager of development and research, has been named director in full charge of activities of that department, and R. E. Wilkin, who has been eastern sales manager, is now general sales manager.

Mr. Murray has been with the Hooker Electrochemical Co. since 1916 in various positions as a production engineer, plant supt., etc. Mr. Babcock has also been employed with Hooker since 1916 and has worked in various departments in production, sales, and research.

410

Liquid Flow Slide Rule

C. J. Major, 2252 15th St., Wyandotte, Mich., has developed a liquid flow slide rule for quick, accurate calculations of pressure drop in pipe lines and tubes.

PORTABLE WIDE-RANGE FLOW TESTING KIT

FOR LABORATORY RESEARCH AND FIELD FLOW RATE CHECKING WORK

ACCURATE
VERSATILE
INEXPENSIVE

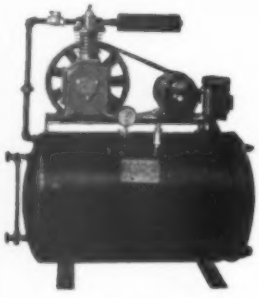
"C-Clamp" FLOWRATOR meter kit. The meter is provided with a convenient carrying handle, base plate and hose connectors.
NET PRICE $91.00

Practically any laboratory or field problem that requires an accurate determination of the flow rates of liquids or gases is readily handled with the versatile F&P FLOWRATOR (formerly called Rotameter) flow meter kit.

The new "C-Clamp" FLOWRATOR instrument kit consists of an extremely flexible combination of one meter, four metering tubes and six readily identified floats. The selection of proper tube and float combinations is simplified. The "C-Clamp" meter construction permits easy disassembly for quick metering tube changes. Capacities from 0.065 to 2200cc/min. of water and 5.0 to 36,800 cc/min. of air are covered. Send for Catalog 30 for details.

FISCHER & PORTER CO.
DEPT. 9P-9F HATBORO, PENNA.

FLOWRATOR
TRADEMARK



No. 2V-APCO

APCO-V-APCO PRIMERS

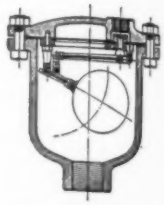
AUTOMATIC POWER OR TANK PRIMERS

AIR RELEASE VALVES

FOR

FILTER PIPE LINES—DISTRIBUTION LINES AND OTHER USES

17 TYPES



No. 200 VALVE

VALVE AND PRIMER CORPORATION **127 N. Dearborn St., Chicago 2, Ill.**

This slide rule solves the rational fluid flow formula, otherwise known as the Fanning or Darcy equation, in a fraction of the time required by usual methods. The slide rule can be used to obtain a pressure drop in a pipe line, carrying capacity of a given pipe line, or diameter of pipe or tube required for a certain quantity of liquid. The rule is applicable to commercial steel, wrought iron, cast iron, asphalted cast iron, or galvanized iron pipe, as well as smooth drawn tubing of brass, copper, tin, lead, glass, etc.

For further information on this new item, use a Reader Service Card on which is entered the above key number and your name and address.

411

Self-Priming Pump

Lawrence Machine & Pump Corp., 371 Market St., Lawrence, Mass., has developed a self-priming pump. Described as "the first real self-priming centrifugal pump", it can be furnished in all sizes and for all classes of service including water, slurry, sludge, acid, and chemicals. It may be used in chemical process industries, in mines, in paper mills, on construction work, in industrial waste treatment, etc.

To obtain information on this new self-priming pump, use a Reader Service Card on which is entered the above key number and your name and address.

412

Boiler Feed Pumps

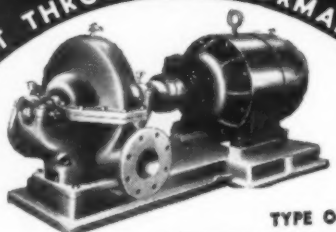
Worthington Pump and Machinery Corp., Harrison, N.J., has announced the addition of four new boiler feed pump sizes to their line of centrifugal pumps. Two are six-inch and two are eight-inch.

To obtain further information fill out a Reader Service Card and mail.

Another Great PUMP "by Aurora"

WINS RESPECT THROUGH PERFORMANCE

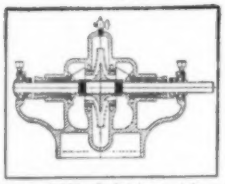
DOUBLE SUCTION



TYPE OD

AURORA CENTRIFUGALS *for Every Pumping Job*
HORIZONTAL SPLIT CASE *Single & Two Stage*
SIDE SUCTION
VERTICAL
NON CLOG
SUMP
MIXED FLOW
SPECIAL DESIGN
Write for CONDENSED CATALOG "M"
or Consult SWEETS

AURORA HORIZONTALLY SPLIT CASE DOUBLE SUCTION SINGLE STAGE CENTRIFUGAL PUMPS



Available in capacities to 4,000 G.P.M. and heads to 300 ft., these accessible, compact, and lasting Type OD Pumps are widely used for general water supply, for municipalities, industrial plants, office buildings, institutions. Also for handling condenser circulating water, wash water, liquids in paper mills and distilleries, chemical solutions, oil in oil fields and refineries, irrigation, etc.

APCO TURBINE-TYPE PUMPS

Here's the Pump for "1001" duties. SIMPLE — only one moving part, the Impeller. Unsurpassed for low capacity, high head duties. Slight change in capacity against drastic head variations.

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BELL and SPIGOT CENTRIFUGALLY CAST IRON PIPE

used EXCELLENT CONDITION

(all 18 ft. lengths)

19,000 ft. of 6" diam.—Class 200
30,000 ft. of 8" diam.—Class 200
6,700 ft. of 10" diam.—Class 150
5,600 ft. of 12" diam.—Class 150
11,000 ft. of 16" diam.—Class 150
1,800 ft. of 18" diam.—Class 150
1,000 ft. of 20" diam.—Class 150
4,700 ft. of 24" diam.—Class 100

Sizes from 10" diam. and larger are cement lined with a coat of bitumastic enamel over cement.

Prompt shipment in carload quantities.

Subject to prior sale.

L. B. FOSTER CO.

(address office nearest you)

New York 7 Pittsburgh 30 Chicago 4 Houston 2 San Francisco 4

T. H. Daugherty Asst. Director Research for Calgon

According to a recent announcement, Dr. Thomas H. Daugherty has been named assistant director of research for Calgon, Inc., Pittsburgh. He will be assistant to Dr. Everett P. Partridge and will be in immediate charge of research and development projects.

At the same time it was announced that C. E. Kaufman was made assistant director of chemical research for Hall Laboratories, Inc.

LITERATURE AND CATALOGS

413
SEWER CLEANING EQUIPMENT

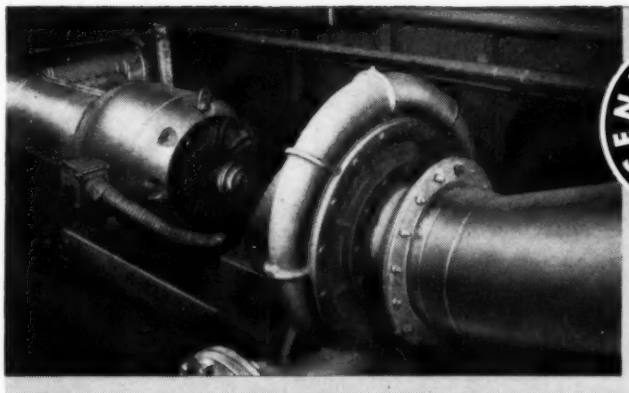
W. H. Stewart, Inc., Syracuse, N.Y., has issued a bulletin on **Sewer & Pipe Cleaning Equipment.** This 22-page bulletin contains a complete description and pictures of all the equipment manufactured by the company for sewer and pipe cleaning. Included are such items as hand tools, sewer rods, complete sewer cleaning machine, engine-driven pipe cleaning machine, windlasses, manhole guides, brush cleaners, porcupine scrapers, etc.

To obtain a copy of this bulletin on sewer cleaning equipment, use a Reader Service Card on which is entered the above key number and your name and address.

414
SEWAGE FLOW METERING

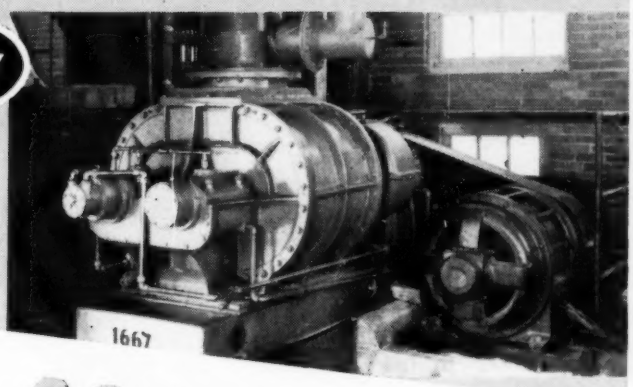
Builders-Providence, Inc., Providence 1, R.I., has issued a reprint of an article on **Sewage Flow Metering and Characteristics at Cranston, R.I.,** by Henry F. Munroe and Walter H. Brown, Jr.

This bulletin describes the metering equipment in use at Cranston, discusses flow and loading analysis,



R-C Centrifugal Blower, type OIB, in foundry service. Capacity 6,000 CFM, at 21 oz. pressure.

ROTARY



R-C Rotary Blower, type RCD, capacity 6,200 CFM.

LET R-C dual-ability SETTLE THE QUESTION

If you are in doubt about whether Centrifugal or Rotary Positive units will do the best job of handling cupola air on any specific application, you can obtain an unbiased answer from R-C *dual-ability*.

Because we build both types, in wide ranges of sizes and designs, we can make sound comparisons and can recommend without prejudice the units whose capacities, pressures, drives and other characteristics deliver the best performance.

Only Roots-Connersville gives you this *dual choice*. It comes from 95 years of designing and building gas and air handling equipment, exclusively.

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The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

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ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS
SPECIAL WATER TREATMENT EQUIPMENT

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ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

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Pioneer Producer of GREENSAND ZEOLITE MINERAL

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With Pearlitic C.I. Bolts for Cast Iron Pipe and Fittings.

Write for Prices.

Carson-Cadillac Co.
1221 PINSON ST. BIRMINGHAM, ALA.

flow variations, and B.O.D. loading, and relief from wide variations. A summary of data at the treatment plant for February 1947 is also given.

To obtain a copy of this reprint, use a Reader Service Card on which is entered the above key number and your name and address.

415
PAYLOADER

The Frank G. Hough Co., 804J Sunnyside Ave., Libertyville, Ill., has issued an attractive new catalog covering a unique four-wheel drive Model HM **"Payloader."**

The literature contains complete specifications on this 1½ cu. yd.

tractor shovel and the numerous uses to which it may be put. This is the type of unit which was described in the September issue of *Water & Sewage Works* as "the machine of 101 uses."

To obtain further information on this machine, use a Reader Service Card on which is entered the above key number and your name and address.

416
ROTARY POSITIVE BLOWERS

Roots-Connersville Blower Corp., Connersville, Ind., has just issued a new booklet on **Rotary Positive Blowers.**

A 20-page bulletin, it discusses the principle uses for this type of blower, and presents operating advantages and principles of operation. Four separate types of blowers are shown, with cross-sections and condensed specifications for each. Also discussed are gears and various types of accessories including relief valves. Several pages of the bulletin are devoted to the more widely known

applications of the Rotary Positive Blower.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

417
PRESSURE AND VACUUM GAUGES

Brown Instrument Co., Philadelphia 44, Pa., a division of Minneapolis-Honeywell Regulator Co., has published a bulletin on **Brown Pressure and Vacuum Gauges.**

Included in the bulletin is complete information on gauges for indicating, recording, and controlling. Also included are pressure actuating elements, high vacuum gauges, control components, etc.

To obtain a copy of this bulletin, use a Reader Service Card on which is entered the above key number and your name and address.

418
WATER MAIN CLEANING

National Water Main Cleaning Co. of New York City, with branch offices throughout the country, has issued a reprint of an article on "Bismarck Cleans Its Water Mains" by E. J. Booth, City Engineer, Bismarck, N. D.

The article originally appeared in the Sept. 1948 issue of the Officia Bulletin of the North Dakota Water and Sewage Works Conference.

This bulletin not only explains how Bismarck cleans its water mains, but shows pictures which amply illustrate the article and show what can be done with water main cleaning.

To obtain a copy of this interesting reprint, use a Reader Service Card on which is entered the above key number and your name and address.

419
CORROSION-RESISTING STEEL

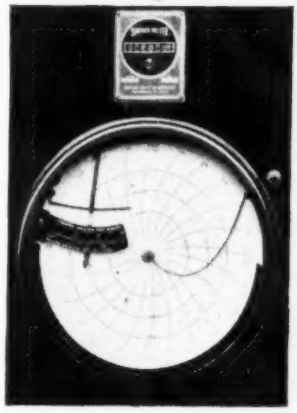
Bethlehem Steel Co., Bethlehem, Pa., has issued a booklet on **Mayari R Bethlehem's High-Strength Corrosion-Resisting Steel.**

This bulletin describes the many and varied uses of this type of steel, particularly for its strength and corrosion resistance. Pictures are given of various applications, products are shown, uses given, etc.

To obtain a copy of this interesting booklet on Mayari R steel, use a Reader Service Card on which is entered the above key number and your name and address.

SIMPLEX
TYPE MS METER

Meets Highest Standards for Accuracy and Sensitivity!



Note these important features:

- Bell shaped float translates the half power of the differential into uniform graduations of dial and chart.
- Evenly spaced charts . . . easily read at high as well as low rates.
- Continuous type integrator — eliminates intermittent movement.
- High accuracy of flow readings—over long ranges—10 to 1 or 7.6 to 1.
- Wall panel or floor mounting—electric or spring wound clock optional.
- Rugged construction—simplified design that permits servicing by plant personnel.

Write for full information to

The Simplex Valve & Meter Company, Dept. 4, 6743 Upland Street, Philadelphia 42, Pa.

SIMPLEX
VALVE AND METER COMPANY

USED
CHEMICAL FEEDERS AND FLOCCULATING EQUIPMENT FOR SALE

1 — **Wallace & Tiernan Type MOH Chemical Feeder** used for hydrated lime. Capacity Min—15 lb/hr—Max 550 lb/hr. 110-volt, single phase, 60-cycle a.c. motor.

1—**Wallace & Tiernan Type MOF Chemical Feeder** used for ferric sulfate. Capacity Min 0.6 lb/hr —Max 80 lb/hr. 110 volts, single phase, 60-cycle, a.c. motor.

1 — **Wallace & Tiernan Ferric Chloride Feeder** having a range from 12½ to 200 gallons per 24 hours.

The motor in the feeder is 110 A.C.

1 — **Wallace & Tiernan Ferric Chloride Feeder** having a range from 125 to 2000 gallons per 24 hours.

The motor in the feeder is 110 A.C.

1—**Dorr Co. Flocculator**—consists of 4 horizontal shaft rotating flocculator mechanisms. The shafts are for a tank 15 feet wide. The rotating arms 6½ feet in diam. by 6 ft. long; 1HP, 220 volt 3-phase, 60 cycle, a.c. gear motor drive unit, chain drives. Paddles and shaft all metal construction. Peripheral speed of paddles adjustable from 0.9 ft/sec. min to 1.2 ft/sec. max.

1 — **Dorr Company, Inc. — 2100 G.P.M. Turbo type Flash Mixer,** with 27"-12" Sextuplex Turbo-Lifter, also 48" Diameter Steel Intake Dish with 18" Throat Opening. Also Sterling System Variable Speed-Trol Power Unit. 3HP, 220V, 60C, 3Ph.

The above equipment was installed in 1937 and has been operated in service about two weeks only. The equipment has been well maintained and is in good condition.

If you wish to make an offer or desire additional information, address correspondence to:

Mr. Robert Burrell
Superintendent
Sewage Treatment Plant
West Haven, Connecticut

420

FIRE HYDRANT

Kennedy Valve Mfg. Co., Elmira, N.Y., has a bulletin No. 61 on their **Standard Fire Hydrant.** This bulletin shows the various features of design and the important advantages deriving therefrom.

To obtain a copy of this folder, use a Reader Service Card on which is entered the above key number and your name and address.

421

CONCRETE SEWERS AND FORCE MAINS

M. W. Loving, Consulting Engineer, P.O. Box 295, Glenview, Ill., has published a 16-page brochure on **Sanitary Sewers and Sewage Force Mains.** Profusely illustrated with photographs of actual installation operations, the bulletin discusses the construction of sewers and force mains with concrete pipe and reinforced concrete pipe.

Among the topics presented are "Design and Test Requirements," "Design of Steel Reinforcement Assemblies for Pressure Pipe," "Report of London Water Board on Burst Water Mains" and "Use of Concrete Pipe for Sewer Systems." Examples of the latter uses are given for a number of cities.

Photographs show the construction of a sewer 12 ft. in diameter, the installation of smaller size sewers, the Stanton-Cornelius flexible pipe joint, testing of concrete pipe for strength, construction of compression wound pipe, hydraulic testing machines, proper jointing, use of the grout-weld gun for patching joints, design of special joints, and many other features. This bulletin

WANTED

Applications are being received for position of superintendent of the sanitary district, Fieldale, Virginia. Qualifications should enable party to take complete charge of water and sewage disposal and entire sanitary district. New installation cost $350,000.

State qualifications, experience and salary expected. Box 115, Fieldale, Virginia.

WANTED

Graduate chemist or sanitary engineer, water testing and purification plant supervision. Address replies to Shenango Valley Water Co., P.O. Box 542, Sharon, Penna.

FOR SALE

CONSULTING ENGINEER'S PRACTICE AND EQUIPMENT. LARGELY MUNICIPAL, IN PACIFIC NORTHWEST.

Write Box 1010

WATER & SEWAGE WORKS
22 West Maple Street, Chicago 10, Illinois

FOR SALE

Item (1)—One 44" Centrifuge Machine, manufactured by the American Centrifugal Corporation. Capable of dewatering sewage sludge, sewage screenings, pulps, etc. Less the drive motors, which are listed below as items (2), (3) and (4)

Item (2)—One 1-H.P. General Electric Induction Gear Motor

Item (3)—One 10-H.P. General Electric Induction Gear Motor

Item (4)—One 75-H.P. General Electric Induction Gear Motor with grids and contactors for push button control

Item (5)—Two 24"x18" Type A-2 Swing hammer Shredder, Jeffrey Mfg. Company, Less Motor and Starter

Bids may be for any or all of the above items and must be received by the Mpls. St. Paul Sanitary District prior to 2:30 P. M., May 23, 1949. For details and required bid form contact the Chief Engineer of the Minneapolis-St. Paul Sanitary District, Box 3598, St. Paul 1, Minnesota.

CAST IRON PIPE

BELL AND SPIGOT

CLASS 150 AND 250

2,100 ft. 4 in. 14,250 ft. 10 in.
11,500 ft. 6 in. 32,450 ft. 12 in.
19,250 ft. 8 in. 3,000 ft. 20 in.
2,100 ft. 24 in.

12 ft. and 18 ft. lengths
Immediate Delivery any quantity
Write — Wire — Phone

SONKEN-GALAMBA CORPORATION
2nd and Riverview (X-377) Kansas City 18, Kansas
THatcher 9243

will be of great interest to consulting engineers and superintendents of both water and sewer systems.

To obtain a copy of this interesting bulletin, mail a Reader Service Card on which is entered the above key number and your name and address.

422

MEEHANITE METAL

Builders Iron Foundry, Providence, R.I., has issued Bulletin No. 28 to give **7 Questions and Answers About Meehanite Castings.**

This 8-page bulletin asks such questions as—What is Meehanite metal? How does it differ from other iron? What are its advantages? Is it brittle? Are its properties dependable in design factors? Where can it be obtained? The satisfactory answers to all these questions are presented in this bulletin which will be of considerable interest to all managers, superintendents, and operators of both water and sewage works.

To obtain a copy of this highly interesting bulletin, mail a Reader Service Card on which is entered the above key number.

423

BELL AND SPIGOT JOINT CEMENT

The Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City 4, N.J., has released an informative folder on **Making Bell and Spigot Joints** with the use of iron cement manufactured by the company.

The folder describes and illustrates three methods by which joints of this type can be made with Smooth-On No. 5, a compound developed specifically for the purpose.

To obtain a copy of this folder, use a Reader Service Card on which is entered the above key number and your name and address.

424

PISTON PACKING

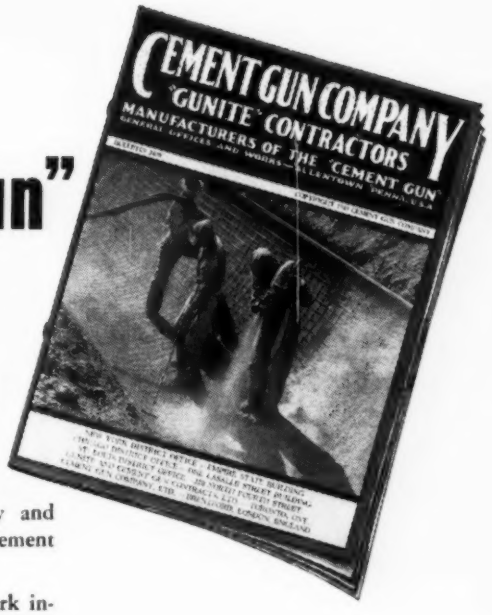
Worthington Pump and Machinery Corp., Harrison, N. J., has published Bulletin W-404-B3 on **Worthington Cup Type Piston Packing.** This four-page folder shows the construction features of the Worthington Cup Packing, and gives the various facts about piston packing and the advantages of one type over another.

To obtain a copy of this bulletin enter the above key number and your name and address on a Reader Service Card and mail.

THE *New*

"Cement Gun" Bulletin

IS READY!



It is filled with "on the job" pictures and describes many of the varied operations we have performed successfully and economically with "Gunite" and the "Cement Gun."

Photographs cover many types of work including repairs to reservoirs, dams, sewers and bridges. Pre-stressed tanks, swimming pools, steel encasement and pile encasement are included as well as other uses and design data and specifications.

A request on your letterhead will bring you a copy by return mail. Ask for Bulletin X2400.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.
MANUFACTURERS OF THE "CEMENT GUN"

want longer filter runs this winter?

N-SOL PROCESSES (activated silica sol) are used in plants to get longer filter runs when temperatures are low. In some cases, the increase has been over 8 hours.

N-Sol Processes are methods by which "N" Silicate is reacted to produce activated silica sol. This, together with alum, forms a larger, tougher, dense floc that settles rapidly. A plus result is clearer effluent—turbidity is often reduced from 1.0 to 0.5.

Investigate now the N-Sol Process for increasing filter runs and decreasing filtered water turbidity. *Free on request*—a handy file of bulletins describing experiences in using activated silica sol for water treatment.

N-Sol-A† — N Silicate reacted with ammonium sulfate. Used where chloramine sterilization is desired.

N-Sol-B — N Silicate reacted with alum. (U. S. Pat. 2310009)

N-Sol-C* — N Silicate reacted with Chlorine. The residual hypochlorite retains the same oxidizing powers produced by normal chlorine sterilization.

Baylis Sol — N Silicate reacted with sulphuric acid. (U. S. Pat. 2217466)

N-Sol-D — N Silicate reacted with sodium bicarbonate.

† U. S. Pat. 2,444,774 * Pat. Applied for

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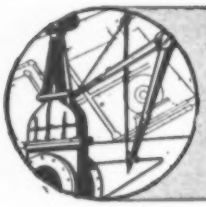
N-SOL PROCESSES FOR WATER COAGULATION



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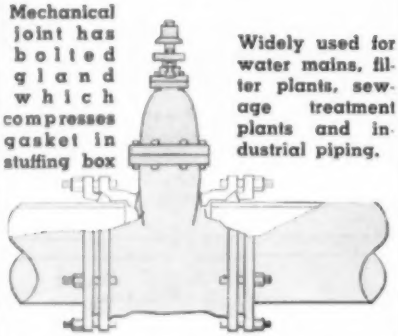

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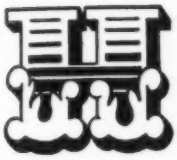

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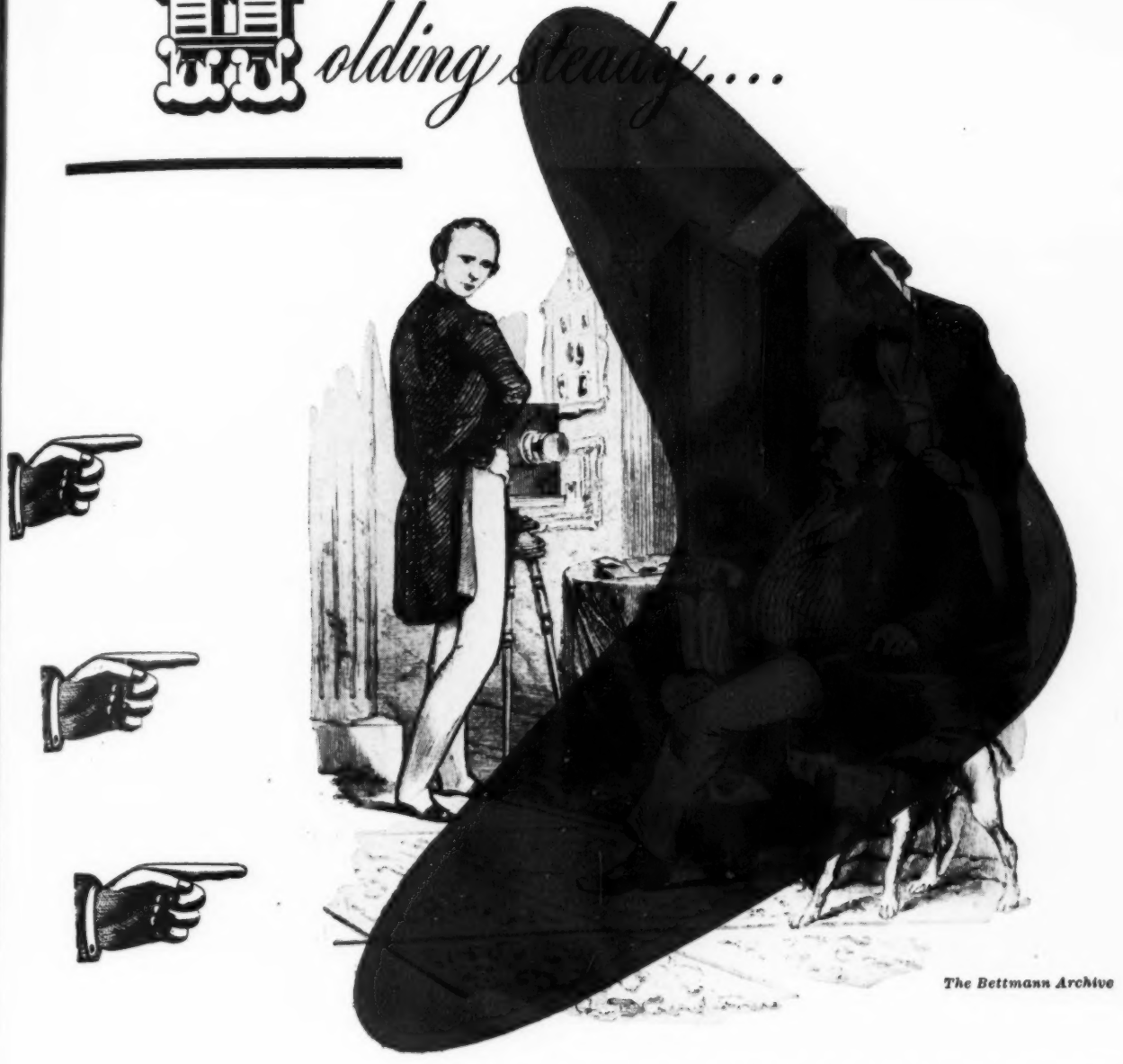

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